

Table of Measurements—Continued.

Current number of specimen .....	22,492 a.	
Locality .....	Schoodic Lakes, Me.	
	Millime- tres.	100ths of length.
Pectoral:		
Distance from snout .....		34
Length .....		18
Length of post-pectoral plate .....		14
Width of post-pectoral plate .....		4
Ventral:		
Distance from snout .....		45
Length .....		19
Branchiostegals .....	III	
Dorsal .....	II, I, 12	
Anal .....	I, 9	
Caudal .....	+ 12 +	
Pectoral .....	10	
Ventral .....	I, 1	
Number of plates in lateral line .....	15	

Additional Radial Formulas.

Current number of specimen .....	22,492 b.	22,492 c.	22,492 d.	22,492 e.	22,492 f.
Locality .....	Schoodic Lakes, Maine.				
	Millime- tres.	Millime- tres.	Millime- tres.	Millime- tres.	Millime- tres.
Extreme length .....	36	33	31	30	30
Length to origin of middle caudal rays .....	31½	28	27	26	26
Dorsal .....	II, I, 12	II, I, 12	II, I, 11	II, I, 10	II, I, 11
Anal .....	I, 9		1, 8	1, 8	I, 8
Caudal .....	12	12			
Pectoral .....	10	10			
Ventral .....	I, 1	I, 1	I, 1	I, 1	I, 1

WASHINGTON, May 14, 1879.

# REVIEW OF THE PLEURONECTIDÆ OF SAN FRANCISCO.

By W. N. LOCKINGTON.

The *Pleuronectidæ* of the Pacific Coast have been described by Girard (Proc. Acad. Nat. Sci. Phil. VII, 1854; VIII, 1856; and Pac. Rail. Rep. Vol. X, 145-156), by Ayres (Proc. Cal. Acad. Sci. 1855, Vol. I, 40, and Vol. II, 1859, 29-30), by Günther (Cat. Fish. Brit. Mus. Vol. IV, 1862, pp. 399-457), and by Gill (Proc. Ac. Nat. Sci. Phil. 1862, 280-281; 1864, 194-199; and 1865, 177). The greater number of the species was characterized by the first of these authors; but as the materials at hand were insufficient for thorough description, consisting usually of single or immature examples, the descriptions were necessarily incomplete. Dr. W. O. Ayres, among the many valuable additions to our ichthyological knowledge made by him during his residence on this coast, added two valid species to the list of our flounders. Dr. A. Günther enumerates the species described by Girard and Ayres, but collocates some of them

in different genera from those in which they were placed by their original describers, and, misled apparently by Girard's insufficient descriptions, characterizes two additional species from specimens which really belonged to forms described by that author. Finally, Prof. T. Gill reviews the labors of his predecessors, reclassifies the entire group, arranging them on a more definite system, and mentions in all seventeen species, including the *Pleuronectes quadrituberculatus* and *Pleuronectes cicatricosus* of Pallas, the *Pleuronectes glacialis* of Richardson (= *franklinii* Günther), and two supposed new species, both of which, however, are apparently synonymous with two of Girard's species; *Parophrys hubbardi* with *Parophrys retulus* Gir., and *Metoponops cooperi* with the *Psettichthys sordidus* of the same author. It will thus be perceived that considerable confusion existed among our flat-fishes; and in the endeavor to identify the various species described by these authors among the examples in the Mus. Cal. Acad. Sci., and to pick them out among the fresh fishes, as they lay, exposed for sale, in the markets of San Francisco, I soon found that the descriptions of external characters already published needed revision and amplification, and that the task of identification was rendered difficult by the great variation in the number of the dorsal and anal fin-rays, in the width of the interocular space, and in the length of the pectorals, in fishes which evidently belonged to the same species.

A new and abundant species, with constant characters by which it could readily be distinguished from the one with which it had probably been hitherto confounded, was also discovered. It was at that time my intention only to take a few additional notes upon the known species, and publish them together with a description of the new form; but, at the suggestion of Prof. D. S. Jordan, of Indiana University, Bloomington, Ind., who is at this time preparing an ichthyology of the United States, which will include all the Pacific Coast species, I undertook the task of redescribing and more thoroughly characterizing all the known forms belonging to the family that occur in the markets of San Francisco.

By repeated visits to the markets, extending over a period of six months, I have verified the occurrence here of all the species hitherto described from this coast, with the exception of the more northern *Pleuronectes franklinii*, and the possible exception of the Pallasian species *quadrituberculatus* and *cicatricosus*. Two new species of rare occurrence, and belonging to a group not hitherto known to be found in our waters, have also been added to the fauna; but as five nominal species are eliminated, the total number of valid forms occurring here is only thirteen.

My method of procedure has been to write a full description from the specimens in the possession of the California Academy of Sciences, and then to incorporate with it the results of notes taken from fresh individuals, altering and adding so as to include the range of variation. The descriptions are not, therefore, from types, but from an examination of several specimens, and a comparison of these with several others. To the descriptions measurements of several specimens (except in the case of

one rare species) are appended; those taken from the preserved specimens and from the fresh individuals in my possession being supplemented by others taken from individuals as they lay on the stalls. The measurements are followed by remarks upon the variation of individuals, by the enumeration of two or three obvious distinguishing characters, and by such notes upon the localities, comparative abundance, &c., of the various forms as I have been able to collect. I greatly regret my inability to do much at present toward the elucidation of the habits, food, and distribution of the several species. The classification adopted is, with one or two exceptions, that which will be followed by Professors Jordan and Gilbert in their forthcoming work;\* and I take this occasion to thank them for the valuable aid they have rendered me by sending me a copy of that portion of their manuscript, and on various occasions tendering me valuable information.

To conclude, I have taken every care to guard against error, but I am aware that it is possible that some of my conclusions may be open to criticism.

I have avoided burdening my descriptions with full synonymy and references, contenting myself with the already given enumeration of the works in which earlier descriptions will be found, and with the mention of the original name of each species.

#### SYNOPSIS OF THE GENERA AND SPECIES.

\* Mouth large, the broad flat maxillary extending to below the eye; teeth nearly equal on both sides of the jaws.

a. Ventral fins both lateral, neither of them on the ridge of the abdomen.

(HIPPOGLOSSINÆ.)

b. Body dextral, eyes and color on the right side.

c. Lateral line with a semicircular arch in front; dentition strong; lower pharyngeal teeth in two rows.....HIPPOGLOSSUS.

1. ....*vulgaris*?

cc. Lateral line nearly straight; teeth rather small; scales moderate, ciliated.

x. No accessory lateral line; dorsal commencing over eye.

HIPPOGLOSSOIDES.

2. Eyes large; lower jaw scarcely projecting.....*jordani*.

xx. An accessory lateral line; dorsal commencing before the eye.

PSETTICHTHYS.

3. Anterior rays of dorsal produced; eyes small.....*melanostictus*.

bb. Body sometimes sinistral, sometimes dextral; dentition strong; lateral line with a semicircular arch in front.....PARALICHTHYS.

4. Accessory scales numerous; scales ciliate.....*maculosus*.

aa. Ventral fin of the colored side inserted on the ridge of the abdomen; body sinistral.....(RHOMBINÆ.)

Lateral line nearly straight; no vomerine teeth; dorsal rays all simple.....CITHARICHTHYS.

5. Scales almost membranous; interocular space concave.....*sordidus*.

\*\* Mouth small, the short narrow maxillary rarely reaching before the front of the eye; teeth mostly on the blind side; body dextral.

(PLEURONECTINÆ.)

\*A Synopsis of the Fishes of the United States. =Bulletin XVI of the United States National Museum.

d. Lateral line simple, nearly straight.

f. Dorsal fin very long, of more than ninety rays; body elongate; scales smooth.....GLYPTOCEPHALUS.

6. Teeth forming a sharp cutting edge, not developed at all on colored side; pectoral of colored side not produced.....*pacificus*.

7. Teeth forming a blunt edge, continued more than half-way along colored side; pectoral of colored side produced.....*zachirus*.

ff. Dorsal fin moderate; scales developed as scattered stellate tubercles.

PLATICHTHYS.

8. Eyes and color sometimes on right, sometimes on left side.

*stellatus*.

dd. Lateral line with an accessory dorsal branch.

e. Teeth slender, acute, in several series; lateral line nearly straight; body deep, short; lips thick.....PLEURONICHTHYS.

9. Interocular space rather narrow, smooth, without ridges..*guttulatus*.

10. Lips plicate; dorsal continued downwards on blind side of head; interocular space very narrow, forming a raised tubercular ridge.

*caenosus*.

ee. Teeth straight, blunt, in a close row, chiefly developed on blind side.

g. Scales cycloid, those on cheeks similar; lateral line nearly straight.

PAROPHYRYS.

11. Snout narrow; upper eye diverted obliquely upwards.....*retulus*.

gg. Scales rough; lateral line arched; form oval.....LEPIDOPSETTA.

12. Scales on cheeks etenoid.....*umbrosa*.

13. Scales on cheeks tuberculate.....*bilincata*.

All the species that I have examined have seven branchiostegals on each side, and the lateral line continued to the end of the caudal on both blind and colored sides. As I am not familiar with the Atlantic species, I cannot be certain whether these are to be considered as family characters; they are not mentioned in Günther's diagnosis of the *Pleuronectidae*.

### HIPOGLOSSUS Cuvier.

Mouth large, the large broad maxillary one-third, or not much more than one-third, of the length of the head. Teeth of upper jaw in a double series. Eyes and color on the right side. Gill-rakers short, compressed, widely set. Lower pharyngeal teeth in two rows; branchiostegals seven. Ventrals lateral; caudal emarginate, the outer rays produced. Scales very small, not ciliated. Lateral line with a semicircular arch in front.

### HIPOGLOSSUS VULGARIS Cuvier (?).

(*Hippoglossus vulgaris*? Ayres.)

D. 102. A. 73. P. 16. V. 6.

The fin-formula given above is that of Ayres. The species is of rare occurrence on this part of the coast, but is occasionally brought to market. As I have as yet only seen one specimen, or rather a part of one, as the greater part of the body had been cut away and sold when I saw it, I cannot pronounce as to its specific identity with *H. vulgaris*. The only notes I could make were as follows: Teeth in a double row in both



jaws, with a few irregular teeth between the rows, about equally developed on both sides, strong, numerous. Branchiostegals seven. Interocular space wider than the length of the eye. Caudal with about 20 rays, the principal rays each several times bifurcate, the posterior margin nearly straight. Weight between 40 and 50 pounds. I am told that this fish will probably be of more common occurrence as the season advances. Toward the northern parts of our Pacific seaboard, at Vancouver's Island and along the shores of British Columbia, the halibut is said to be quite common, and to attain a weight of 70 to 100 pounds, or even more. Specimens from Alaska, I am told, have been identified by Dr. Bean with the Atlantic *H. vulgaris*.

#### HIPPOGLOSSOIDES Gottsche.

Mouth large; maxillary broad, flat, extending nearly to the centre of the eye; teeth nearly equal on both sides of the jaws, rather small, conical. No teeth on vomer or palatines. Eyes and color on the right side. Anterior nostrils on colored side with a short tube, on blind side with a raised margin; lower pharyngeal teeth in a single row. Dorsal commencing over the upper eye; ventrals both lateral; caudal entire, its middle rays produced. Scales of moderate size, more or less strongly ciliated; lateral line nearly straight, simple. Branchiostegals seven.

#### HIPPOGLOSSOIDES JORDANI sp. nov.

D. 90-94. A. 71-75. C. 2-15-2. P. 13. A. 6.

Dorsal and abdominal outlines equally and regularly curved from the line of the centre of the eyes to the caudal peduncle; upper outline of snout strongly curved, almost a quadrant, the junction of this curve with the dorsal outline forming a concavity over the anterior half of the upper eye. Peduncle of tail widening posteriorly, in its narrowest part from about  $\frac{2}{9}$  to  $\frac{2}{7}$  of the greatest depth of the body, which is a little over  $\frac{1}{3}$  to  $\frac{2}{8}$  of the total length; length of the head from  $\frac{4}{15}$  to less than  $\frac{1}{4}$  of the total length; eye contained about  $4\frac{1}{2}$  times; snout (measured from a line joining the anterior margins of the orbits to the tip of the upper jaw)  $5\frac{1}{2}$  to 6 times in the length of the head. Posterior nostrils of both sides situated on a line joining the front margins of the orbits; anterior nostrils on both sides with a raised margin, prolonged posteriorly into a linguiform flap; the posterior sub-elliptical, simple. Lower jaw not, or scarcely, projecting in the closed mouth; its lower straight border forming an obtuse angle with the abdominal outline, and its prominent posterior extremity below the centre of the eye; a knob at the symphysis. Cleft of mouth oblique, the tip of the premaxillaries on a horizontal line with the upper margin of the lower eye, and the posterior broad end of the maxillaries extending to nearly the centre of the lower border of the same. Dentition consisting of numerous sharp, slender, conical recurved teeth, in an irregular single row in the man-

dible, but forming a double row in the intermaxillaries. Front teeth largest in both jaws. The outer row in the intermaxillaries much larger than the inner, which is formed of very small teeth; but most of the outer row smaller than those of the mandible. The teeth on the colored side of the upper jaw are most numerous and smallest. Upper pharyngeals each with two irregular rows of teeth, the hinder largest, conical, sharp, recurved. Lower pharyngeals each with a single row of similar teeth. Eyes rather large, lateral, equal in front. Interorbital space rather narrow, equal in adults to about one-third of the longitudinal diameter of the eye. Gill-rakers long and slender, those of the first branchial arch about equal in length to the width of the interorbital space. Pectoral of the colored side scarcely  $\frac{1}{2}$  of the total length, or slightly more than half the length of the head, inserted level with the lower eye, and consisting of 13 rays, the first two simple, the others once or twice bifurcate; the third ray longest, lower rays diminishing regularly. Pectoral of the blind side equal in width to that of colored side, but only about  $\frac{2}{3}$  as long. Dorsal commencing on the dorsal ridge immediately over the anterior margin of the pupil, all the rays simple, except the two or three last, which (at least in most examples) are once bifurcate; the rays from the 37th to the 50th highest. Anal preceded by a horizontal spine, the first ray immediately behind a vertical from the posterior axil of the pectoral; all its rays simple, the three last excepted, coterminous with the dorsal, rays from 30th to 40th highest. Posterior margin of caudal entire, slightly convex, rays twice or thrice bifurcate. In large individuals, both the central and the outer rays are slightly produced, the central most. Ventrals small, inserted in advance of the pectorals, the distance between the posterior axil of the former and the anterior axil of the latter less than half the width of the pectoral base; their tips extending backwards beyond the anus nearly to the anal spine; the first two rays simple, the others once or twice bifurcate. Lateral line without abrupt arch, curving gently downwards from its origin to the median line of the side of the body, which it reaches at a vertical from the tip of the pectoral; thence straight to the end of the caudal. Number of scales in lateral line about 96 in a specimen  $9\frac{3}{4}$  in. long. No accessory lateral line, but a row of pores across cheek and round the lower eye. Scales of colored side longer than wide, rather small, distinctly ciliate on their posterior margins, somewhat deciduous; uniform over the whole of the body opercles and cheeks, and continued forwards on the interorbital space to the anterior margin of the eye. Jaws and snout scaleless; scales of blind side not ciliated. A row of small ciliated scales along each ray of the dorsal and anal on the colored side, extending almost or quite to the tips of the rays; none on the first four dorsal rays; caudal with small scales on colored side; color almost uniform gray. Each scale has two transverse bands of black points, divided by a spotless light-colored band; the ciliated tip is also light, with a few black points. Fins nearly the same tint as the body, the

membrane between the rays of dorsal and anal becoming slightly darker towards the tips of the rays.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.
Total length, in inches.....	9 $\frac{3}{4}$	10 $\frac{1}{4}$	17 $\frac{1}{2}$	14 $\frac{3}{8}$
Length without caudal .....	8	8 $\frac{5}{8}$	.....	12 $\frac{3}{4}$
Greatest depth of body .....	3 $\frac{5}{16}$	3 $\frac{13}{16}$	6 $\frac{3}{4}$	5 $\frac{5}{8}$
Length of head .....	2 $\frac{1}{2}$	2 $\frac{5}{8}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$
Width from tip of dorsal to tip of anal .....	.....	.....	10 $\frac{3}{8}$	8 $\frac{3}{8}$
Longitudinal diameter of eye .....	$\frac{9}{16}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{3}{4}$
Length of snout, from a line joining the front margins of orbits .....	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{8}$
Interocular space .....	$\frac{1}{8}$	.....	$\frac{9}{16}$	$\frac{1}{4}$
Length of pectoral, colored side (probably maimed).....	1 $\frac{5}{16}$	1 $\frac{7}{16}$	2 $\frac{3}{8}$	1 $\frac{1}{2}$
Length of pectoral, blind side .....	$\frac{7}{8}$	1	1 $\frac{5}{8}$	1 $\frac{5}{8}$
Length of ventral .....	$\frac{1}{2}$	.....	1 $\frac{1}{8}$	1
Origin of anal to lateral line .....	2	.....	4 $\frac{5}{8}$	3 $\frac{1}{2}$
Greatest distance from anal to straight part of lateral .....	2 $\frac{3}{8}$	.....	4	3 $\frac{1}{8}$
Width of peduncle of tail, narrowest part .....	$\frac{3}{16}$	$\frac{1}{8}$	.....	.....
Height of centre rays of dorsal.....	$\frac{1}{16}$	.....	.....	.....
Length of lower jaw.....	1 $\frac{7}{16}$	.....	.....	1 $\frac{1}{16}$

Although this species is of quite common occurrence in the markets of San Francisco, it appears to have hitherto escaped description, probably on account of its external resemblance to Girard's *Psettichthys melanostictus*, from which it is not distinguished by the dealers, who are able to discriminate between most of the other species. With several other kinds, it is sold under the name of "Sole." From *melanostictus* it may be known by the more backward origin of the dorsal fin, the first rays of which are lower than those next following; by the larger eyes and rather narrower interocular space; the absence of an accessory dorsal branch to the lateral line, and the want of conspicuous black dots on the colored side. The surface is decidedly less rough than that of *melanostictus*, although the scales are ciliated. The number of scales in the lateral line is rather difficult to count, but there are about fourteen to an inch in an example 14 $\frac{5}{8}$  long (caudal included).

No. 1 had 90 dorsal and 71 anal rays; No. 2, D. 94, A. 72; and No. 4, D. 93, A. 75.

In the stomach of No. 2 were three half-digested anchovies (*Engraulis ringens*) and a shrimp-like crustacean (*Hippolyte*).

No. 2 had about 42 teeth in the mandible, and at least 62 in the intermaxillaries, those on the colored side most numerous and smallest; while in No. 4 the mandible had 14 teeth on the blind, and 11 on the colored side, the intermaxillaries about 14 on the blind, and numerous (ca. 50) small teeth on the colored side, without counting the inner row of still smaller teeth.

From *H. limandoides* = *dentatus*, of the Atlantic, the present species differs in having more dorsal and anal rays, and in the presence of an anal spine.

I have taken the liberty to name this species after my friend Prof. D. S. Jordan, in acknowledgment of the assistance and advice I have received from him.

PSETTICHTHYS Girard.

Mouth large; maxillary broad, flat, extending to the front of the pupil; teeth well developed on both sides of the jaws, irregular. No teeth on vomer or palatines. Eyes and color on the right side; anterior nostril on colored side tubular, that on blind side with a flap. Lower pharyngeal teeth in a single row. Dorsal commencing in advance of the upper eye; ventrals lateral; caudal entire. An accessory lateral line on both sides of the body; lateral line nearly straight. Scales ciliated. Branchiostegals seven.

The only one of Girard's original characters which remains to distinguish this genus from *Hippoglossoides* is the more anterior commencement of the dorsal; as a thorough examination of specimens larger than those described by that author ( $4\frac{3}{4}$  in. long) proves that ciliated scales are common to both genera. The presence of an accessory lateral line is, however, a character which appears sufficient to warrant the separation of this form as a genus or sub-genus, since it is used as a generic character in the *Pleuronectine*.

PSETTICHTHYS MELANOSTICTUS Girard.

D. 78-88. A. 58-62. C. 3-6-6-3. P. 11. V. 6.

Body elongated, narrow; dorsal and abdominal outlines regularly curved and nearly equal from nape and ventrals to caudal peduncle; curve of snout joining that of nape over the anterior half of the upper eye; abdominal outline from posterior end of mandible to ventrals nearly straight. Greatest depth contained in the total length from about three to a little more than two and a half times; head four to five times in the same. Eyes small, contained seven to eight times; snout (measured from orbit of upper eye to tip of intermaxillaries) about five times in the length of the head; peduncle of tail from three and a half to four times in the greatest depth. Anterior nostril on colored side with a short tube, the opening wide and anterior; that on blind side with a raised margin or short tube, prolonged posteriorly; posterior nostril on both sides without flap, its posterior border in advance of the anterior border of the orbit. Eyes equal in front, lateral; interocular space smooth, not elevated, of variable width. Mouth large, oblique; lower jaw considerably the longer, its tip, in the closed mouth, level with the lower margin of the upper eye; a prominent symphysial knob; mandible joining the abdominal outline at an obtuse angle. Posterior extremity of the maxillary extending to a vertical drawn from the front of the pupil. Teeth rather small, in a single row on both sides of both jaws, conical, sharp, recurved, those in front much the largest in both jaws, and those in the mandible larger than those in the intermaxillaries (ex-

cept three or four large canines in front of the latter). Teeth on colored side of upper jaw very small, numerous. In adults about 33 teeth in the mandible, 43-50 in the intermaxillaries. A single row of six or seven sharp, conical, recurved teeth on each upper pharyngeal; lower pharyngeals very slender, each armed with a row of about twelve slender, sharp, recurved teeth. Gill-rakers of first branchial arch about half the length of the eyes, flexible, those of the other arches similar, but shorter. Origin of dorsal a little in advance of the anterior margin of the upper eye, and immediately above the posterior nostril of the blind side; its anterior rays over the eyes and on the occiput higher than those immediately behind them, but not quite equal to the longest rays of the central portion of the fin, which are from about the thirtieth to the fortieth rays. The first ray is twisted to the left, toward the nostril. From the central rays the fin declines regularly to its termination opposite to that of the anal, and distant from the caudal about half the depth of its peduncle. Anal with an acute horizontal spine, its origin opposite the centre of the length of the pectoral, and its longest rays opposite to those of the dorsal. Peduncle of caudal very slightly dilated at the base of that fin, the posterior margin of which is convex, and the principal rays once or twice bifurcate, the first bifurcation at about one-third of their length from the base. Pectoral of colored side with eleven rays, the rays, except the first two, once bifurcate; that of the blind side nearly equal in size and similarly bifurcate. Ventrals inserted with their posterior axil about half the width of the pectoral base in advance of the anterior axil of that fin; their rays once or twice bifurcate, and their extremity falling short of the vent. Lateral line very slightly raised above the pectorals, about 107-118 scales between its origin and that of the caudal in a specimen eleven inches long. An accessory lateral line along the base of the dorsal, ending about under the 24th dorsal ray on the colored side, and under the 17th-20th on the blind side. A branch from this accessory line to the main lateral line at back of head; a line of pores, indistinct in small specimens, more distinct in larger, can be traced from the lateral line across the cheek to the lower margin of the upper eye; and a little behind the end of this a row of pores branches downwards around the lower eye, ending opposite the posterior margin of the pupil. Scales very small, imbricate, ciliate, extending over head and gill-covers; snout and lower jaw scaleless. Free end of each scale truncate. A single row of small scales along each ray of the dorsal and anal on the colored side, except on about the first third of the dorsal and the first two or three rays of the anal. Caudal covered with small ciliated scales on the colored side almost to the tip of the rays, and with smooth scales on the colored side. Scales of blind side smooth, a few scales on the bases of the central rays of the dorsal and anal on this side. Color of right side ash-gray, interspersed with crowded black dots just large enough to be perceptible with the naked eye; numerous black points on the exposed part of each scale. When

fresh the ground-tint is lighter, and the black points much less distinct than after exposure to the air. Left side uniform white.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Total length, in inches.....	6½	10½	11	14½	15	15½	17	17½
Greatest depth of body .....	2½	4	3½	5½	4½	5½	6	6½
Distance from tip of lower jaw to origin of anal, in a straight line .....		3½	3½					
Length of head .....	1½	2½	2½	3½	3½	3½	3½	3½
Width of interocular space .....		⅞	⅞	⅞		⅞		⅞
Longitudinal diameter of lower eye.....		⅞		⅞		⅞		⅞
Length of snout, from orbit of upper eye .....			⅞	⅞		⅞		⅞
Length of pectoral, colored side .....		1½	1½	1½		1½		
Length of pectoral, blind side .....			1	1½		1½		
Length of ventrals .....			¾					
Height of longest dorsal rays.....		1½	1½	1½		1½		1½
Height of longest anal rays .....			1½			1½		1½
Height of first dorsal ray .....				1½		1		1½
Length of lower jaw .....				1½		1½		1½
Width of peduncle of tail.....		¾	1½			1½		1½
Greatest distance from anal to straight part of lateral line .....			1½	2½		3½	3½	
Number of rays in dorsal .....	82	88	82			81		84
Number of rays in anal .....	62	60	60			58		60

As will be seen by the foregoing figures, the width of the interocular space, the length of the pectorals, that of the caudal peduncle, and the number of rays in the dorsal, are very variable.

In the stomach of an example 7½ inches in length were the half-digested remains of two anchovies (*Engraulis ringens*) each about three inches long.

This is the most common of the species sold as "Sole" in the markets of this city. Most of the individuals brought to market are from ten to twelve inches in length; but many reach sixteen or even eighteen inches. The black dots over the upper side, the long anterior dorsal rays, inserted more in advance than is usual, and the small eyes, render this fish easy to recognize.

#### PARALICHTHYS Girard.

Mouth large, the broad, flat maxillary reaching to the posterior margin of the lower eye; teeth in a single row on both sides of both jaws; eyes and color usually sinistral. Lower pharyngeals covered with villiform teeth; villiform teeth on the first pair of upper pharyngeals; also a row of larger teeth. Remainder of upper pharyngeal teeth like the larger of the first pair. Gill-rakers long. Anterior nostrils on both sides with a flap. Dorsal commencing above eye; anal without a spine; caudal sinuous on its posterior border; ventrals both lateral. Lateral line with a semicircular arch in front; no accessory lateral line. Scales ciliate; numerous accessory scales on their posterior margins.



## PARALICHTHYS MACULOSUS Girard.

*Cropsetta californica* Gill, 1864.*Hippoglossus californicus* Ayres.

D. 69-76. A. 53-60. C. 3-12-3. P. 10-12. V. 6.

Body elongated, dorsal outline forming a low regular curve from the junction of the snout to the caudal peduncle; snout rather long, a slight depression over the anterior part of the upper eye, where it joins the dorsal outline. Abdominal outline from the extremity of the mandible to the caudal peduncle forming a curve corresponding to that of the dorsal outline. Greatest depth a little less than  $\frac{3}{8}$ ; length of head about  $\frac{7}{32}$  of the entire length; eye about  $\frac{1}{8}$ — $\frac{1}{7}$ , snout  $\frac{3}{14}$  of the length of the head; interocular space  $\frac{1}{10}$ — $\frac{1}{7}$  of the same; width of caudal peduncle about  $\frac{1}{4}$  of the greatest depth; greatest distance from anal to straight portion of lateral line less than the length of the head. Anterior nostrils of both sides with a tongue-like flap on their posterior border; posterior nostrils patulous, small, slightly in advance of the orbit. Eyes equal in front, small, the upper well below the dorsal ridge, yet somewhat directed upwards. Interocular space smooth, flat, not elevated, a scarcely perceptible ridge from origin of lateral line to upper eye, where it divides, forming a raised margin to the posterior portion of that eye; a short ridge over the anterior part of the upper margin of the lower eye; in large individuals the width of the interocular space exceeds the length of the eye. Mouth large; maxillary reaching to a vertical from the posterior margin of the lower eye, and to a distance below that eye exceeding its longitudinal diameter. Mandible about  $\frac{9}{16}$  of the length of the head, its tip level with the upper margin of the lower eye; its straight lower border forming a very obtuse angle with the abdominal outline; a slight symphysial prominence. Teeth in both jaws slender, acute, slightly recurved, about 15 in the upper and 8 in the lower jaw in individuals under 12" long, besides numerous rasp-like teeth in the hinder part of the intermaxillary. The front teeth in the mandible are longer and more recurved than those farther back. First pair of upper pharyngeals a cushion of villiform teeth, with a row of about 12 larger recurved ones; second and third harpygeals united, with three or four irregular rows of teeth like the larger of the first pair; lower pharyngeals covered with villiform teeth. Gill-rakers of first pair of branchial arches slender, flexible, nearly as long as the eye. Dorsal commencing over the front margin of the upper eye; the first ray slightly twisted to the left; the length of the rays increasing but slightly to its greatest height in the centre of its length, and thence diminishing very slowly, forming a low arch; the distance between its termination and the origin of the caudal about equal to the depth of the caudal peduncle; dorsal and anal coterminous. A few of the posterior rays of the dorsal and anal are bifurcate. Anal without spine, its origin very slightly behind the vertical from the anterior axil of the pectorals, and forming a low arch similar to that fin, the longest rays equal in length to those of the dor-



sal. Caudal with an undulating posterior margin, the central rays and outer rays somewhat produced; all the principal rays three or more times bifurcate. The longest dorsal rays are about the 30th-38th; the longest anal rays about the 15th-23d. Pectoral of the colored side about half the length of the head, and contained in the total length between nine and ten times; its rays once or twice bifurcate, the first two excepted; the third ray longest, the twelfth about half its length; pectoral of the blind side considerably shorter than that of colored side; its rays simple or some of them once bifurcate. Ventrals inserted more than the width of the base of the pectoral in front of that fin, their tips reaching nearly to the fourth anal ray; their length about half, or a little more than half, that of the pectoral of the colored side; the four posterior rays once bifurcate. Scales of body small, very finely ciliate on their free margin, covering the whole of the body and the head to the middle of the length of the interorbital space, and extending up the dorsal and anal rays nearly to their tips. Some on the broad end of the maxillary. Along the free margin of each of the principal scales is ranged a variable number of much elongated, narrow, accessory scales, easily rubbed off. Numerous similar supernumerary scales on the dorsal and anal rays. Scales of blind side smaller than those of colored side, smooth, with accessory scales as on colored side. Caudal covered with scales on both blind and colored sides; some in front of the central rays of dorsal and anal on blind side. Lateral line, in small individuals, containing about 100 scales between its origin and that of the caudal, and raised above the pectoral into a bold arch of a diameter exceeding the length of the pectoral, and a height about equal to the length of the ventral. Color dark reddish brown to slaty gray above, whitish below; usually five small light bluish spots along the dorsal region, and four along the abdominal. In large individuals, the spots are obsolescent or wanting.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Total length, in inches .....	10	9 $\frac{3}{8}$	12 $\frac{3}{8}$	11 $\frac{1}{2}$	21 $\frac{7}{8}$
Length without caudal .....	8 $\frac{5}{8}$	8 $\frac{1}{8}$	10 $\frac{3}{8}$	9 $\frac{1}{2}$	18 $\frac{3}{8}$
Greatest depth of body .....	3 $\frac{5}{8}$	3 $\frac{5}{16}$	4 $\frac{5}{16}$	4	7 $\frac{1}{4}$
Length of head .....	2 $\frac{3}{8}$	2	2 $\frac{1}{2}$	2 $\frac{1}{2}$	4 $\frac{1}{8}$
Greatest distance of anal to straight part of lateral line .....	1 $\frac{7}{8}$	1 $\frac{1}{2}$	2 $\frac{1}{4}$	2 $\frac{1}{2}$	.....
Tip of lower jaw to origin of anal .....	2 $\frac{1}{4}$	2 $\frac{1}{2}$	2 $\frac{15}{16}$	2 $\frac{13}{16}$	5 $\frac{1}{4}$
Longitudinal diameter of eye .....	$\frac{1}{8}$	$\frac{3}{32}$	$\frac{1}{2}$	$\frac{3}{16}$	$\frac{1}{8}$
Interocular width .....	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{3}{8}$
Length of snout from upper eye .....	$\frac{3}{32}$	$\frac{7}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	1
Length of lower jaw .....	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{3}{8}$	1 $\frac{1}{2}$	2 $\frac{1}{2}$
Length of pectoral of colored side .....	1	1	1 $\frac{1}{4}$	1 $\frac{3}{8}$	2 $\frac{1}{4}$
Length of pectoral of blind side .....	1 $\frac{1}{8}$	$\frac{5}{8}$	1 $\frac{1}{8}$	$\frac{7}{8}$	1 $\frac{7}{8}$
Length of ventrals .....	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	1 $\frac{1}{8}$	1 $\frac{3}{8}$
Length of arch of lateral line .....	1 $\frac{1}{8}$	1 $\frac{1}{8}$	1 $\frac{1}{8}$	1 $\frac{1}{8}$	3
Rise of arch of lateral line .....	2 $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{8}$	1
Width of caudal peduncle .....	1 $\frac{1}{2}$	$\frac{7}{8}$	1 $\frac{1}{2}$	1	.....
Longest dorsal ray .....	.....	.....	.....	.....	1 $\frac{1}{8}$
Longest anal ray .....	.....	.....	.....	.....	1 $\frac{1}{2}$

This is not of very frequent occurrence in our markets, although it can scarcely be called rare. It attains a larger size than any other of our species except the true *Hippoglossus*, and it is probably this circumstance, together with its elongated form, that has led the fishermen to name it the "Bastard Halibut." Large specimens are sold under this name, but immature individuals are retailed as "Turbot." The largest I have yet seen weighed, respectively, 43 and 58 pounds, and the latter measured about 4 feet 10 inches in length when entire. It is very seldom taken in the bay, and is said to be of more frequent occurrence southwards than northwards, but I cannot at present ascertain its southern range. From its occurrence at Monterey it is often called the Monterey halibut. It is said to be a tough, coarse fish. It is taken as far north as Tomales Bay. Nos. 1, 2, 3, and 4 (of which the dimensions are given) are young alcoholic specimens in the Museum of the Cal. Acad. Sci., and their dorsal and anal fin-rays were, respectively, D. 76, A. 60; D. 70, A. 55; D. 70, A. 55; and D. 71, A. 53. No. 5 had 69 dorsal and 53 anal rays. Some specimens have a few pores on the occiput behind and above the horizon of the upper eye, running downwards and backwards towards the lateral line. The number of scales in the lateral line is very difficult to count. From all the other Californian species with large jaws, it may be known by its elongate form and boldly arched lateral line.

I have for some time suspected that *Uropsetta californica* (Ayres) Gill, and *Paralichthys maculosus* Girard, were identical, and I think that I can now demonstrate their identity beyond reasonable doubt. My suspicion arose as follows: The large specimens of the Monterey halibut, weighing 40–50 pounds, are considered by all the dealers to be of the same species as the small specimens, and, from their general similarity, no doubt as to their identity with each other and with *Uropsetta californica* arose in my mind until, on critically comparing a small individual with Girard's description of *P. maculosus*, I found that it agreed with the latter in every particular except in its sinistral eyes and color. Now arose two questions: 1st. Were the large individuals really specifically identical with the small ones? 2d. Was there a dextral form, and, if so, was the dextral form a distinct species?

I have not yet had the opportunity to take full measurements of a full-grown individual, as all the large ones I have seen were cut up before I examined them, but I have the following reasons to give for including all under one species:

1st. The form of the caudal fin and the outline of the posterior part of the body are alike in large and small sinistral individuals; the former having the sinuous posterior margin, with the central and external rays produced, described by Girard as characteristic of *P. maculosus*.

2d. The smaller sinistral individuals agree with Ayres's description of *Hippoglossus* (*Uropsetta*) *californicus*, except in the form of the tail, which is shown as slightly concave in Ayres's figure (Proc. Cal. Acad.

ii, 1860, fig. 10). The figure is but a sketch, and is inaccurate in many respects.

3d. The larger individuals are always sold as "halibut," attain the dimensions of the true halibut, and are evidently identical with Ayres's species.

4th. The small sinistral individuals have all the characters of *Paralichthys maculosus* Gir., except the position of the eyes and color, and some difference in the color of the spots.

These reasons, although they point strongly towards identity, do not prove it; but I have lately procured an individual (No. 5) which has the characteristics of Ayres's species, yet is *dextral*, thus agreeing exactly with that of Girard; so that I can now add to my reasons—

5th. A specimen of dimensions intermediate between that of Girard (7' long) and the large individuals before mentioned has the characters of *U. californica*, but is *dextral*, as stated by Girard in his description of *P. maculosus*. In this specimen, the interorbital area is proportionally much wider than in the smaller examples, exceeding the longitudinal diameter of the eye; and the row of spots along the dorsal and abdominal outlines, so evident in the small individuals, is almost obsolete, traces of one or two of the posterior ones being all that is left of them. The principal caudal rays are many times dichotomized, the base of the fin is fleshy, and its scaly covering is very conspicuous; some of the rays of the right pectoral are twice bifurcate; about eight of the posterior rays of the dorsal and anal are bifurcate; each ray of the dorsal and anal (except the most anterior and posterior) is seen to have, upon its anterior face, a row of principal scales, and numerous accessory scales, all resembling those of the body, but smaller; each scale of the body is seen to be followed by several supernumerary scales arranged around its posterior margin; and the pectoral of the colored side has only ten rays; that of the blind side eleven. As this is the only *dextral* example out of about ten individuals that have come under my observation, I am inclined to believe that *dextral* specimens are comparatively rare, at least on this part of the coast. As the generic name *Paralichthys* has precedence over that of *Uropsetta*, it must be retained for the species, which must henceforth be known as *Paralichthys maculosus*.

#### CITHARICHTHYS Bleeker.

Mouth large, the broad, flat maxillary more than one-third the length of the head, and extending to below the pupil. Eyes and color on the left side. Teeth in both jaws in a single series, unequal in size, nearly equally developed on both sides of the jaws; no vomerine or palatine teeth. Lower pharyngeal bones with a single row of teeth. Gill-rakers lanceolate. Branchiostegals seven. Dorsal fin commencing on the snout; dorsal and anal rays simple; ventral fin of colored side inserted on the ridge of the abdomen. Lateral line nearly straight. Scales moderate.

*Metoponops* Gill is evidently identical with *Citharichthys*. All the characters usually considered generic agree; and the specific characters given (Proc. Acad. Nat. Sci. Phil. 1864, 198) are those which properly belong to *Citharichthys sordidus* Girard. Girard's description, taken from an immature individual  $5\frac{1}{2}$  in. long, is in many respects defective; that of Gill approaches much nearer to completeness, but, as it was taken from a single sun-dried specimen, it shows characters which arise from the drying.

CITHARICHTHYS SORDIDUS (Girard) Günther.

*Psettichthys sordidus* Girard.

D. 92-99. A. 72-81. C. 3-11-3. P. 13. V. 6.

Outline of body sub-ellipsoid, but the dorsal and abdominal outlines not correspondent, the highest point of the former situated over the tip of the pectoral, while the lowest point of the latter is below the base of the same fin. Snout almost continuous with the dorsal outline, which rises rapidly to the highest point in a bold curve, and thence falls with a gently sigmoid curvature to the caudal peduncle. Abdominal outline almost straight to the ventrals, thence with a slight sigmoid curve around the lowest point to the caudal peduncle. Thus the hinder part of the body tapers gradually in a line which becomes slightly concave, both above and below, as it approaches the caudal peduncle. Greatest depth of body contained  $2\frac{3}{8}$  times; length of the head  $4\frac{1}{3}$  times in the greatest length; longitudinal diameter of eye about  $\frac{1}{3}$ , snout (measured from the lower eye) about  $\frac{1}{6}$  of the length of the side of the head. Distance from origin of anal to lateral line slightly in excess of the length of the head; peduncle of tail short, about  $\frac{1}{5}$  of the greatest width, slightly widening toward caudal. Eyes elliptical, large, the upper turned somewhat upward, the lower lateral, and about  $\frac{1}{5}$  of its longitudinal diameter in advance of the upper; interocular space equal to about half the transverse diameter of the eye, and made to appear narrower by an elevated ridge, which, commencing on the cheeks, passes along the posterior lower margin of the upper eye, descends obliquely to the upper margin of the lower orbit, and continues to the intermaxillary. A less prominent ridge along the lower margin of the upper eye, merging in the principal ridge where it commences to descend. Thus the anterior and larger portion of the interocular area is concave. Nostrils of colored side in a line with the upper margin of the lower eye; anterior nostrils of both sides with a long narrow flap in front; posterior simple. The anterior nostril of the colored side has also a raised margin, prolonged somewhat posteriorly. Mouth large, oblique; extremity of the mandible slightly projecting, and on a level with the upper margin of the pupil of the lower eye when the mouth is closed. The lower border of the mandible almost in a straight line with the anterior part of the abdominal outline. Posterior extremity of the maxillary extending to a vertical drawn midway between the

centre and the front of the pupil of the lower eye. Teeth slender, acute, incurved, closely set at regular distances from each other, gradually increasing in size forwards; about equal in size on both sides of both jaws, and extending the full length of the gape on both sides. Upper pharyngeals each with a single row of 6-8 slender, rather long, sharp, recurved teeth; lower pharyngeals each with a single functional row of similar teeth, all but some of the most anterior buried in the gum almost to their points; lower pharyngeal bones separate. Gill-rakers of 1st pair of branchial arches about equal in length to the width of the interocular space, rather stiff; those of the other arches gradually diminishing to the fourth; spinulose on their upper edge. Dorsal arising a little before the anterior rim of the upper orbit, close behind the posterior nostril of the blind side; gradually increasing in height to about the 38th-48th rays, which are behind the highest point of the dorsal outline, and thence rapidly decreasing; the last rays small and closely set. Anal arising vertical with the posterior axil of the base of the pectorals; its longest rays (23d-27th) somewhat deeper than those of the dorsal are high. From these rays the depth of the fin diminishes rapidly to its termination opposite that of the dorsal; the posterior rays, like those of that fin, very small and closely set. No anal spine visible externally. Posterior margin of caudal almost straight when closed, but slightly wedge-shaped; the centre rays longest, when opened out; principal rays bifurcate three times. Pectoral of left or colored side about  $\frac{1}{6}$  of the total length, and consisting of thirteen rays, all, except the first three, once bifurcate; fourth ray longest. Pectoral of right side  $\frac{3}{5}$ - $\frac{2}{3}$  of the length of that of the colored side; rays simple. Ventrals short, but broad at base and broadly rounded when opened, their tips extending beyond the third anal ray, and the posterior margin of their base situated a little anterior to the anterior axil of the pectoral. Ventral of the colored side on the abdominal ridge; rays simple. Lateral line almost straight, yet rising somewhat anteriorly; very distinct; tubes simple. Number of scales between base of caudal and head 65-70. No lines of pores on head. Scales rather large, very thin and flexible, deciduous, almost membranous, smooth; the free end truncate, each pocket of the dermis bordered by a delicate membrane of darker color than the scale, and often broken up into tags; engaged portion of scale with slight radiating striae. Those of the anterior portion are as deep as long, or even deeper; those of the posterior part of the body and of the caudal peduncle are more or less elongated. The scales vary much in size and shape; the largest are on the abdominal region behind and below the pectoral; the smallest around the eyes and on the interorbital space, snout, and lower jaw; the two latter only partially covered with scales. Dorsal and anal with a row of small scales along each ray on the colored side. Caudal scaly at the base, and with the membrane between the rays covered with scales on both sides. Scales of blind side similar to those of colored. Color dull reddish yellow; the outline of each scale rendered distinct by the margin of darker membrane behind each scale;

vertical fins of a uniform dark slaty tint. Color of blind side uniform creamy.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Total length, in inches .....	9 $\frac{3}{4}$	12	11	10 $\frac{1}{4}$	9 $\frac{1}{2}$
Length without caudal .....				8 $\frac{1}{2}$	8 $\frac{1}{2}$
Greatest distance from origin of anal to lateral line.....	2 $\frac{5}{16}$	3	2 $\frac{5}{8}$	2 $\frac{3}{8}$	2 $\frac{3}{8}$
Greatest depth of body.....	3 $\frac{5}{8}$	4 $\frac{5}{8}$	4	3 $\frac{1}{16}$	3 $\frac{7}{8}$
Length of head .....	2 $\frac{1}{4}$	2 $\frac{3}{4}$	2 $\frac{9}{16}$	2 $\frac{3}{8}$	2 $\frac{5}{16}$
Length of pectoral, colored side .....	1 $\frac{1}{16}$	1 $\frac{1}{8}$	1 $\frac{1}{4}$	1 $\frac{1}{8}$	1 $\frac{1}{4}$
Length of pectoral, blind side .....		1 $\frac{3}{16}$	1 $\frac{5}{16}$	1 $\frac{3}{8}$	1 $\frac{5}{8}$
Length of ventrals .....	$\frac{9}{16}$	$\frac{7}{8}$	$\frac{7}{8}$	1 $\frac{1}{16}$	$\frac{3}{8}$
Longitudinal diameter of eye .....	$\frac{9}{16}$	$\frac{8}{8}$	$\frac{4}{4}$	$\frac{1}{16}$	$\frac{1}{16}$
Length of snout, from lower eye .....			$\frac{7}{8}$	$\frac{1}{2}$	$\frac{7}{16}$
Width of interocular space, about.....	$\frac{5}{32}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{5}{16}$
Longest dorsal ray .....			1 $\frac{1}{2}$		
Length of lower jaw .....			1 $\frac{5}{16}$	1 $\frac{1}{32}$	1 $\frac{1}{32}$
Width of peduncle of tail, narrowest part.....			$\frac{3}{32}$		$\frac{3}{32}$
Number of dorsal rays .....			92	92	99
Number of anal rays .....			76	75	81

Three other specimens, the fin-rays of which were counted, had respectively D. 95, A. 72; D. 93, A. 76, and D. 98.

Girard gives the number of dorsal rays as 82, while none of the specimens which I have examined have less than 92. As the range in number of dorsal and anal fin-rays is considerable in the individuals I have examined, it is quite possible that some may have as few as 82 dorsal rays; but the close agreement in the number of anal rays found by Girard and by myself leads me to suppose that the number 82 is a typographical error.

This is a tolerably common species in our markets, but is usually taken outside of the bay. I have not yet seen any exceeding 12-14 inches in length.

From No. 5 was taken a specimen of *Engraulis ringens*, which it had only partially swallowed when caught; the tail hanging out of the mouth.

The *Engraulis* thus appears to be a favorite article of food with at least three of our large-mouthed flat-fishes. This species may be readily recognized by its sinistral coloration and eyes, its smooth scales, dirty yellow color, and the gradual tapering of the body into the caudal peduncle, with a concave curve on both dorsal and abdominal outlines. Unlike *Platichthys stellatus* and *Paralichthys maculosus*, this species appears to be invariably sinistral.

#### GLYPTOCEPHALUS Gottsche.

Form extremely elongated; mouth small, the short, narrow maxillary scarcely reaching the front margin of the eye; teeth most developed on the blind side, incisor-like, broad, equal, forming a continuous cutting edge. No vomerine or palatine teeth. Upper pharyngeal bones each with an obliquely transverse row of about nine bluntly conical teeth; lower pharyngeals with a single row of similar teeth. Branchiostegals seven. Eyes and color on the right side. - Anterior nostrils with a short



tube, prolonged posteriorly. No accessory lateral line; lateral line very nearly straight. Dorsal fin very long, of more than ninety rays; scales smooth. Anal with or without a spine; caudal convex on posterior margin.

The following two species are separated by well-marked characters from each other; but I have not considered it necessary to use a different generic name for *G. zachirus*, in which the anal is preceded by a spine, and the teeth are continued farther on the blind side.

GLYPTOCEPHALUS PACIFICUS sp. nov.

D. 99-104. A. 80-87. P. 10-12. V. 6. C. 3-8-8-3.

Form elongate ellipsoid, dorsal and abdominal outlines curving regularly and similarly from head to caudal peduncle, which slightly increases in width posteriorly. Snout continuous with dorsal outline, but slightly more curved; lower margin of head straight. Greatest width contained about  $3\frac{3}{4}$ , head more than 5 times in the total length, or the former about  $3\frac{1}{4}$  and the latter about  $4\frac{1}{2}$  times in the length without the caudal. Eyes about  $\frac{1}{4}$ — $\frac{2}{7}$ ; snout (measured from the lower eye)  $\frac{1}{5}$ — $\frac{1}{7}$  of the length of the head. Anterior nostril on both sides tubular, the tube short, its posterior margin produced into a flap; posterior without flap. Nostrils small; hinder margin of posterior nostril about vertical with the anterior margin of the upper orbit. Lower eye somewhat in advance of the upper, which reaches the dorsal profile at its anterior extremity. Interorbital space a very narrow, smooth, somewhat elevated ridge of bone. Cleft of mouth nearly equal on both sides, very small, oblique; the maxillary reaching but little beyond a vertical from the anterior margin of the lower eye, and scarce so far as a vertical from that of the upper. Tip of mandible level with the centre of the lower eye, and scarcely projecting in the closed mouth. Lips tolerably well developed. Teeth broad, thin, incisor-like, forming a continuous sharp cutting edge along the blind side of both jaws, but in both ending rather abruptly before reaching the colored side. Twelve teeth in the lower and nine or ten in the upper jaw; those at the anterior commencement of the row slightly smaller than the others. Upper pharyngeal bones with 5-9 sharp conical teeth on each, the anterior with the greatest number; lower pharyngeal teeth in two rows, sharp, conical, those of the inner row larger than those of the outer, except in front, where there are a few larger teeth; equal in size in both rows. Gill-rakers short, slender, flexible, lanceolate. Dorsal and anal long and low, similar, coterminous, fleshy at base; the rays simple, their tips free. Dorsal commencing opposite the centre of the pupil of the upper eye, the longest rays a little behind the centre of the length of the fin, and about  $\frac{1}{4}$  of the width of the body in length. No spine before anal, the first ray of which is only a little posterior to the hinder pectoral axil, and its longest rays opposite and equal to those of the dorsal. Distance from the end of the dorsal and anal fins to the caudal equal to about half the depth of the caudal peduncle. Caudal with three or four accessory rays on each side, not very wide; posterior



margin slightly convex when opened, the principal rays twice bifurcate. Pectorals small; that of colored side contained about  $8\frac{1}{2}$  times in the total length; rays twelve in number, once bifurcate. Pectoral of blind side scarcely three-fourths as long as that of the colored side; rays nine or ten, some of them bifurcate. Ventrals very small, inserted about the width of the pectoral base in advance of the anterior axil of that fin; their length contained more than five times in that of the head. Lateral line straight, passing along the median line of the side of the body and of the caudal, about 140 scales from its origin to the base of that fin. Scales very small, smooth, becoming smaller along the dorsal and abdominal margins; smaller scales continuing for some distance upwards and downwards on the bases of both the dorsal and anal, upon both blind and colored sides, especially upon the latter, where scales cover the whole surface between as well as upon the rays. The bases of the pectorals and caudal are also covered with scales on both sides. On the fore part of the anal, the scales reach to the tips of the rays. The scales upon the fins are much smaller than those upon the body. Scales on blind side smooth; snout scaleless. Color nearly uniform dark blackish gray; the scales covered on their exposed portion with black points, which cannot be distinguished by the naked eye. Blind side opaque white, with numerous small black dots evenly distributed. Fins on colored side with the membrane light slate-color, sprinkled with small black dots; the rays and scales of the same color as the body. Distal margins of all the fins considerably darker. The black dots extend to the interior of the mouth, covering the hyoid surfaces, and the pharyngeal teeth are tipped with reddish orange.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Total length to tip of caudal, in inches .....	$8\frac{9}{16}$	$8\frac{3}{4}$	$10\frac{3}{16}$	$8\frac{7}{16}$	$8\frac{1}{2}$
Length without caudal, about .....	$7\frac{3}{8}$	$7\frac{3}{4}$	$8\frac{7}{8}$	$7\frac{1}{16}$	$6\frac{7}{8}$
Greatest depth, about .....	$2\frac{1}{4}$	$2\frac{5}{8}$	$3\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{3}{8}$
Length of head .....	$1\frac{11}{16}$	$1\frac{1}{2}$	$1\frac{11}{16}$	$1\frac{1}{16}$	$1\frac{1}{8}$
Length of pectoral, blind side .....	$\frac{11}{16}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{16}$
Length of pectoral, colored side .....	1	$\frac{3}{4}$	$1\frac{1}{16}$	$\frac{1}{16}$	1
Length of ventrals .....	.....	$\frac{1}{16}$	(*)	$\frac{3}{8}$	$\frac{1}{16}$
Diameter (longitudinal) of eye .....	.....	$\frac{1}{16}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{1}{16}$
Width of interorbital space .....	.....	$\frac{1}{16}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{1}{16}$
Length of snout, horizontal, from lower eye .....	.....	$\frac{1}{2}$	$\frac{3}{8}$	.....	.....
Distance from tip of mandible to origin of anal .....	2	$1\frac{1}{16}$	.....	$1\frac{1}{8}$	$1\frac{1}{4}$
Width from tip of highest rays of dorsal to tips of ditto of anal .....	$3\frac{5}{16}$	$3\frac{1}{16}$	4	.....	.....
Width of caudal peduncle in narrowest part .....	.....	.....	$\frac{1}{16}$	$\frac{3}{16}$	$\frac{5}{16}$
Length of snout from lower eye .....	.....	$\frac{1}{2}$	$\frac{3}{8}$	.....	.....
Distance from tip of mandible to origin of anal .....	2	$1\frac{1}{16}$	.....	$1\frac{1}{8}$	$1\frac{1}{4}$
Length without caudal, about .....	$7\frac{3}{8}$	$7\frac{3}{4}$	$8\frac{7}{8}$	$7\frac{1}{16}$	$6\frac{7}{8}$
Width from tip of dorsal to tip of anal rays .....	$3\frac{5}{16}$	$3\frac{1}{16}$	4	.....	.....
Width of caudal peduncle .....	.....	.....	$\frac{1}{16}$	$\frac{3}{16}$	$\frac{5}{16}$
Length of lower jaw .....	.....	.....	$\frac{1}{16}$	$\frac{1}{2}$	$\frac{1}{2}$
Origin of anal to lateral line .....	.....	.....	$1\frac{1}{8}$	$1\frac{1}{16}$	$1\frac{1}{4}$
Number of dorsal rays .....	104	102	99	.....	101
Number of anal rays .....	87	84	80	.....	86

\* Damaged.

† Scarcely.

The scales upon the body and fins are highly deciduous, and the lateral line is much less distinctly pronounced than in the succeeding species. Although the lowest pair of branchiostegals is not easy to make out, I have no doubt that seven is the correct number. The individual  $10\frac{3}{16}$  in length, No. 3, is the largest I have yet seen, and is probably adult. In flavor this fish is inferior to *G. zachirus*. This species was certainly not brought to market during the winter months. I first saw it March 15, and from that date to the end of April a few have usually been exposed for sale, but it cannot be said to be abundant. It is not taken within the bay.

The dark color, elongated form, and correspondingly long dorsal and anal fins render this species easy to distinguish from every other except *G. zachirus*, from which it can be known by its short pectoral, entire want of teeth on colored side, and more pointed form of the front part of the head, as well as by the absence of an anal spine. *G. pacificus* differs from *G. cynoglossus* of the Atlantic in the greater relative length of the head, the smaller number of teeth in the upper jaw, and the smaller number of dorsal and anal rays.

GLYPTOCEPHALUS ZACHIRUS sp. nov.

D. 94-106. A. 79-89. C. 5-6-7-4. P. 11-13. V. 6.

Body elongate-ovate, the anterior portion of the oval shorter than the posterior; snout declivous, almost vertical, its tip level with the upper margin of the lower eye, and its curve uniting without sensible depression with that of the nape; dorsal outline rising with a regular gentle curve from the snout to about the twenty-second dorsal ray, thence declining very gradually and regularly with but slight curvature to the caudal peduncle. The abdominal outline is almost straight from the knob of the mandible to the ventral; from thence to the end of the anal curved in the same manner as the dorsal outline. Peduncle of tail slightly expanded towards the caudal, its least width about one-fourth of the greatest depth of the body. The greatest width of the body is contained from  $3\frac{1}{3}$  to  $3\frac{1}{2}$  times, and the length of the head from about  $5\frac{1}{3}$  to  $5\frac{1}{2}$  times in the total length; the eye about  $3\frac{1}{3}$  times, and the snout about 8 times in the length of the head. The greatest distance from the anal to the lateral line is less than the length of the head. Eyes large, elliptical, lateral, the lower in advance of the upper about half the length of the pupil, and scarcely reaching the dorsal profile anteriorly. Interocular space very narrow, about  $\frac{1}{8}$  of the longitudinal diameter of the eye, smooth, not raised above the eye in a fresh fish. A slight ridge rises at its posterior part, forms the lower posterior margin of the upper eye, and dies out on the cheek. Nostrils of right side level with the upper margin of the lower eye; the anterior with a short tube, the posterior with a raised margin, and vertical with the front margin of the lower orbit. Posterior nostril of blind side in advance of the eye; anterior nostril nearly as on colored side.

The nostrils are small and inconspicuous. Gape of mouth very small on colored side, considerably larger on the blind side. On the colored side the cleft is nearer vertical than horizontal; the posterior end of the maxillary reaches very little behind the anterior margin of the orbit of the lower eye, and the symphysis of the intermaxillaries is about level with the upper edge of the orbit. Mandible projecting in the closed mouth, short, not passing a vertical from the front margin of the pupil, with a prominent knob below the symphysis, and a smaller one at its posterior extremity. Teeth on both sides of the jaws throughout the full length of the gape, in a single row, broad, but thick, forming a blunt continuous edge, about thirty-four in the lower jaw and rather fewer in the upper in an individual  $11\frac{3}{16}$ ' long. In an example  $14\frac{5}{8}$ ' long there were 14 teeth on the colored and 26 on the blind side of the mandible, the latter the larger; in the intermaxillaries, 13 on the colored and 23 on the blind side. Each lower pharyngeal with a double row of teeth, the inner larger than the outer; the four anterior teeth of the outer row conspicuously larger than those following. About 12 teeth in each inner row. Upper pharyngeals each with a close-set row of 6-7 blunt conical teeth. Branchiostegals seven; gill-rakers few, flexible, very short. Dorsal commencing between the front of the orbit and the pupil, considerably behind the nostrils, long and low, forming a continuous arch of slightly greater curvature than the dorsal outline, the longest rays in the central portion, and ending opposite to the anal at about two-thirds of the width of the caudal peduncle from the origin of the caudal. Anal with a horizontal spine, the first ray rather distant from the visible portion of the spine, and nearly the length of the ventral behind the pectoral base; similar to the dorsal. Almost all the rays of dorsal and anal directed backwards. Caudal convex on posterior margin, rather narrow, the rays once bifurcate, sometimes bifurcate again near the tips. Pectoral of colored side exceedingly long and lanceolate, about one-fourth of the total length of the fish; the first five rays simple, the others once bifurcate. Fourth ray longest, fifth nearly equal, sixth a little longer than the third, thence diminishing rapidly. Usual proportion of the first four rays 3-8-10-12. Pectoral of blind side lanceolate, rather more than one-third of the length of that of the colored side, and formed of the same number of rays, the first four simple, the others once forked; fourth and fifth rays longest. Ventrals inserted so that their hinder axil is vertical with, or a little posterior to, the anterior axil of the pectoral; their tips reaching to the first anal ray; the four posterior rays once bifurcate. Lateral line almost straight, rising very slightly anteriorly, formed of a double row of tubes, about 138 in number, excluding those upon the caudal. A row of similar pores commencing at the ridge under the upper eye, and continuing around the lower eye almost to its front margin. Scales small, smooth, uniform over the body, and extending over the head to the snout, on which they are smaller. Intermaxillaries and mandibles scaleless. Scales of blind side similar. Caudal scaly on both sides;

no scales on the other fins. Color uniform brownish or cinereous; fins darker. The color formed by minute dark spots on the scales. Membrane between fin-rays closely set with dark points. Blind side whitish, the ground tint clouded with numerous black points.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.
Greatest length, in inches .....	11 $\frac{2}{16}$	12 $\frac{3}{8}$	12 $\frac{1}{2}$	14 $\frac{3}{8}$
Length without caudal .....	9 $\frac{5}{8}$	.....	10 $\frac{1}{2}$	12 $\frac{1}{2}$
Greatest depth of body .....	3 $\frac{1}{2}$	3 $\frac{5}{8}$	3 $\frac{5}{8}$	4 $\frac{1}{2}$
Greatest depth over dorsal and anal fins .....	.....	5 $\frac{1}{2}$	.....	.....
Length of head .....	2 $\frac{1}{16}$	2 $\frac{1}{8}$	2 $\frac{1}{2}$	2 $\frac{5}{8}$
Longitudinal diameter of lower orbit .....	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{2}{3}$
Width of interocular space .....	.....	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{3}{32}$
Length of snout, from lower eye .....	$\frac{1}{2}$	.....	$\frac{3}{32}$	$\frac{3}{8}$
Length of pectoral, colored side .....	3 $\frac{1}{2}$	2 $\frac{1}{16}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$
Length of pectoral, blind side .....	1	1	1 $\frac{5}{8}$	1 $\frac{3}{8}$
Length of ventrals .....	2 $\frac{1}{2}$	.....	1 $\frac{3}{8}$	1 $\frac{3}{8}$
Width of caudal peduncle .....	$\frac{3}{4}$	.....	$\frac{3}{2}$	1
Distance from tip of lower jaw to first ray of anal .....	2 $\frac{1}{2}$	.....	3 $\frac{1}{16}$	.....
Greatest distance from anal to lateral line .....	1 $\frac{1}{16}$	.....	2 $\frac{1}{8}$	2 $\frac{3}{8}$
Length of lower jaw .....	.....	1 $\frac{1}{2}$	.....	2 $\frac{3}{8}$
Length of longest dorsal ray .....	.....	1 $\frac{3}{32}$	1 $\frac{1}{8}$	1 $\frac{1}{16}$
Length of snout, from upper eye .....	$\frac{1}{32}$	.....	$\frac{1}{16}$	$\frac{1}{8}$
Number of dorsal rays .....	97	94	106	98
Number of anal rays .....	80	79	89	81

Two other specimens had respectively D. 94, A. 80, and D. 94, A. 82. The length of the pectoral, as might be expected in so long and narrow a fin, varies somewhat; and the proportional length of the first five rays is not constant. No. 4 was measured while perfectly fresh; the others after a few days' immersion in alcohol. In the fresh fish, the interocular space is not raised above the eyes, and the upper boundary of the orbit is hard to define; but, in alcoholic specimens, the interocular space stands out as a narrow ridge of bone. Like the preceding species, *G. zachirus* is of rare occurrence in the markets, and is not taken in the Bay of San Francisco.

During the six months previous to March none were taken; but the dealers assure me that it usually makes its appearance, in limited quantities, in the spring months. Most of the dealers, however, do not distinguish between this fish and the preceding one, and sell both as "Sole."

One dealer, who evidently knew the fish, describing it by its long pectoral, assured me that its flavor was superior to that of any other of our species; I mention this because I had myself previously come to the same conclusion. Its flesh is very firm and white, and its flavor approaches that of the true sole. No. 4 is the largest I have seen, and from the answers I obtain to enquiries, I believe it is beyond the average size. The long pectoral, bluff snout, and presence of teeth on the colored side of the mouth at once distinguish this species from the preceding, as well as from every other species. The nostrils in this and the pre-

ceding species are similar, the anterior having a short tube or funnel, produced posteriorly into a flap; but the flap is shorter in this species than in the other.

### PLATICHTHYS Girard.

Form broad; mouth small; maxillary short, not reaching to the pupil of the lower eye; teeth blunt, in a single row, most developed on the blind side of both jaws. Eyes sometimes on the right, sometimes on the left side. Anterior nostril of colored side tubular; that of blind side with a posterior flap. Dorsal not in advance of the eye; anal with a horizontal spine; caudal with the central rays most produced posteriorly. Lateral line slightly arched anteriorly; no accessory dorsal branch. Scales developed as scattered stellate tubercles, forming a regular series along the dorsal and abdominal outlines, and on each side of the lateral line. Branchiostegals seven; gill-rakers short; pharyngeal teeth tubercular.

### PLATICHTHYS STELLATUS (Pallas) Girard.

(*Platichthys rugosus* Girard.)

D. 54-61. A. 42-44. C. 3-6-6-3. P. 11-12. V. 6.

Form broad and short; outline, including dorsal and anal, broadly rhombic; dorsal and abdominal outlines of the body boldly and regularly curved; snout less declivous than the dorsal outline, which it joins over the centre of the eye; caudal peduncle long, the sides straight for some distance behind the end of the dorsal and anal fins. Greatest height of the body contained  $2\frac{1}{6}$ - $2\frac{1}{2}$  times, head rather more than 4 times in the greatest length; eye about 6 times, snout (measured horizontally from the lower eye) about 6 times in the length of the head; caudal peduncle about 5 times in the greatest depth of the body. Nostrils of colored side in a depression in a line with the centre of the interocular space, the anterior tubular; anterior nostril of blind side with a posterior flap and a raised margin, posterior without flap. Eyes equal in front, or nearly so, the lower sometimes very slightly in advance, the upper eye looking obliquely upwards. Interocular space less than half the longitudinal diameter of the eye; a low prominence running upwards and backwards from the anterior upper margin of the lower eye to the posterior lower border of the upper eye, and thence backwards to the origin of the lateral line; above the operculum this rises into a prominent tubercle. Mouth small; mandible projecting somewhat in the closed mouth, its tip level with the upper margin of the lower eye, and its lower margin forming a very slight angle with that of the head; posterior end of the maxillary reaching a vertical slightly in advance of the lower eye. Teeth short, broad, forming an irregular cutting edge, in a single row in both jaws, most developed on the blind side, but extending more than half-way along the colored side. Upper pharyngeal bones each with an irregular series of tubercular teeth, sometimes more or

less broken into smaller rows; lower pharyngeal bones broad, covered with tubercular teeth. Gill-rakers short, broadly conical at base, about as long as the interocular is wide, flexible, widely separated. Dorsal commencing above the middle of the eye, highest in the centre, about the 31st-32d ray, thence diminishing regularly and in nearly a straight line to its termination at a distance from the caudal equal to the depth of the caudal peduncle. The longest rays are about  $\frac{2}{3}$  of the length of the head, and placed a little behind the broadest part of the body. Anal with a more or less conspicuous spine, similar in shape to the dorsal, and coterminous with it. Sixteenth ray longest, the rays behind this diminishing in nearly a straight line to the end of the fin; the longest anal rays shorter than those of the dorsal. Caudal rather large, its rays once bifurcate; posterior margin with the central rays more or less produced. Pectoral of colored side contained about twice in the length of the head; the rays from the third to the ninth once bifurcate. Pectoral of blind side rather shorter than that of colored; its first five rays simple. Ventrals of six simple rays, a vertical from the posterior margin of their base touching the anterior axil of the pectoral base, their tips reaching the anal spine, but falling short of the first ray of that fin. Scales of body formed of scattered, stellate, tuberculate bodies, irregularly disposed on both blind and colored sides, but smaller upon the former, and closer together on the cheeks and interocular space than on the body. A few on the snout; front part of snout and greater part of lower jaw scaleless. A regular row of rather larger scales accompanies the lateral line on both sides, above and below. Scales on caudal peduncle elongate, subimbricate, rough on their posterior edges only. A bare space on the operculum, and another on the cheek, of the blind side. A regular row of large, stellate, irregularly shaped, rough scales between the bases of the dorsal and anal fin-rays, one between each pair of rays; these scales larger than those of the rest of the body. No scales on dorsal or anal; caudal rough, with very small scales on the base and outer rays of the colored side, and to a less extent on those of the blind side. Lateral line with a slight curve above the pectoral; the rise much less than the width of the base of that fin; the anterior extremity nearly horizontal. A row of pores from a little above the lower margin of the upper eye around the lower to front of pupil. No scales on lateral line; pores tubular; about 83 between base of caudal and head in an individual  $9\frac{3}{4}$  in length. Color olivaceous, with areas of citrine when fresh; the blind side white. Dorsal and anal fins with four, caudal with three, black bands running in the direction of the rays, the lighter portions of these fins reddish brown or olivaceous. Individuals colored on both sides, except on a small portion of the blind side, and others having nearly the whole of the eyed side white are occasionally brought to market.

*Localities.*—Kamtschatka, Behring's Straits, Vancouver Island, Fraser River, (*fide* Günther); Humboldt Bay, San Francisco.



In 1862, Prof. Gill and Dr. A. Günther identified this species with the *Pleuronectes stellatus* of Pallas.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Total length, in inches.....	8 $\frac{1}{16}$	9 $\frac{3}{8}$	14 $\frac{1}{8}$	22 $\frac{3}{8}$	13 $\frac{1}{8}$
Length without caudal.....	6 $\frac{1}{16}$	.....	11 $\frac{1}{8}$	.....	11 $\frac{1}{8}$
Greatest height of body.....	3 $\frac{1}{16}$	3 $\frac{1}{16}$	6 $\frac{1}{4}$	10 $\frac{1}{8}$	6 $\frac{3}{16}$
Height from tip of dorsal to tip of anal.....	.....	.....	.....	.....	9
Distance from tip of lower jaw to origin of anal.....	2 $\frac{1}{16}$	3 $\frac{3}{8}$	.....	.....	4 $\frac{1}{16}$
Length of head.....	1 $\frac{1}{16}$	2 $\frac{3}{16}$	3 $\frac{1}{2}$	5 $\frac{1}{2}$	3 $\frac{3}{8}$
Longitudinal diameter of eye.....	1 $\frac{1}{16}$	.....	.....	.....	1 $\frac{1}{16}$
Width of interocular space.....	.....	.....	.....	.....	.....
Length of snout, from lower eye.....	.....	.....	.....	.....	.....
Length of longest ray of dorsal.....	.....	.....	.....	.....	.....
Length of longest ray of anal.....	.....	.....	.....	.....	.....
Length of pectoral of colored side.....	.....	.....	.....	.....	.....
Length of pectoral of blind side.....	.....	.....	.....	.....	.....
Length of ventral.....	.....	.....	.....	.....	.....
Width of caudal peduncle where narrowest.....	.....	.....	.....	.....	.....
Distance from end of dorsal to caudal fin.....	.....	.....	.....	.....	.....
Greatest distance from anal to straight portion of lateral line.....	.....	.....	.....	.....	.....
Length of caudal.....	.....	.....	.....	.....	.....

The formulæ of the fin-rays of dorsal and anal in these specimens were as follows: No. 1, D. 61, A. 42; No. 2, D. 60, A. 43; No. 3, D. 59, A. 42; No. 4, D. 58, A. 43; No. 5, D. 59, A. 44. Nos. 1 and 2 are alcoholic specimens, and have both eyes and color upon the right side.

This is the most abundant of all the flat-fishes brought to our markets, and attains a larger size than any other except the Bastard Halibut (*Paralichthys maculosus*) and the Hippoglossus. Those taken in San Francisco Bay attain a weight of eight, ten, or even twelve pounds, while still larger individuals are brought from Humboldt Bay. Those brought from the latter locality are, however, very coarse and comparatively poor in flesh, so that they do not fetch by far so high a price as those taken near San Francisco. It is sold under the name of "Flounder," which here appears to be limited strictly to this species. Its broad rhombic form, elevated dorsal, deep anal, long caudal peduncle, stellate scales, and the bands of color which adorn the vertical fins, give this fish an unmistakable *facies*. The eyes and color are sometimes upon the right and sometimes upon the left side. Out of sixty-five individuals, which I counted as they lay upon the stall, thirty-two were colored upon the right and thirty-three upon the left side. On another occasion I counted seventy-five sinistral and fifty-eight dextral individuals, and on a third thirty-eight dextral and forty-eight sinistral. Is it not possible that the difference of color may be a sexual one? This is the idea of the more intelligent dealers, but it has not been verified by dissection. Individuals occasionally occur with both sides olivaceous, some white blotches alone marking the usually uncolored side; on the other hand, I have seen one example which had both sides white, except along the dorsal and abdominal outlines and head of the eyed side.



## PLEURONICHTHYS Girard.

Form broad; eyes and color on the right side. Mouth small; maxillary narrow, short; teeth in several series, slender, acute, most developed on the blind side. No teeth on vomer or palate. Lips more or less thick. Lower pharyngeals with a double row of teeth. Gill-rakers short, flexible. Anterior nostrils on both sides with a flap; posterior patulous. Dorsal of less than eighty rays. Anal preceded by a spine; dorsal and anal rays simple. Branchiostegals seven; no free preopercular margin.

## PLEURONICHTHYS GUTTULATUS Girard.

*Hypsopsetta guttulata* Gill.

*Parophrys ayresii* Günther.

D. 66-72. A. 47-54. P. 11-13. C. 3-12-3. V. 6.

Form broadly oval; the dorsal outline regularly curved from the snout to the peduncle of the tail. Curve of snout meeting that of dorsal outline over the centre of the eye, forming a slight concavity. Abdominal outline running downwards and backwards in a straight line to the origin of the anal, thence to the caudal peduncle curved like the dorsal. Form, including dorsal and anal fins, broadly rhombic. Height of body nearly to quite half of the total length from the tip of the snout to that of the caudal; length of head nearly to rather more than  $\frac{1}{3}$  of the same; caudal peduncle  $\frac{1}{6}$ - $\frac{1}{8}$  of greatest depth. Snout short, about  $\frac{2}{3}$  of the diameter of the orbit. Nostrils on a line with the upper margin of the lower eye; anterior nostril on both eyed and blind side with a flap behind; posterior patulous. Eyes about  $\frac{1}{3}$  of the length of the head, the lower slightly in advance of the upper, which is slightly directed upwards. Interocular space narrow, smooth, elevated, about  $\frac{1}{3}$  of the longitudinal diameter of the eye. Mouth small, very oblique, lower jaw scarcely projecting, the tip of the mandible about level with the top of the pupil of the lower eye; maxillary reaching a little beyond the front margin of the lower orbit. Lips rather thick. A broad band of villiform teeth in front in both jaws; continued also along the blind side in the intermaxillary and the mandible, but along the colored side in the mandible only. Pharyngeal teeth cardiform, in two or three irregular rows on each upper pharyngeal bone, and in a double row on each of the lower. Gill-rakers very short, blunt, flexible, distant. No free margin to preoperculum, the skin covering and uniting that bone to the other opercular bones. Dorsal commencing a little in front of the centre of the eye, highest about the 37th ray, which is about half the length of the head. Dorsal and anal forming an obtuse rounded angle, giving the fish a rhombic form. Anal usually with a spine, its longest rays opposite and equal in length to those of dorsal; its origin very slightly behind a vertical from the posterior axil of the pectoral. Anal and dorsal coter-

minal at about  $\frac{1}{3}$  of the depth of the caudal peduncle from the caudal fin. Caudal slightly and regularly convex on its posterior margin, its rays thrice bifurcate. Pectoral of colored side narrow; the rays, except the first two, bifurcate; its length equal to the distance of the lower eye from the tip of the operculum, or about  $\frac{2}{17}$  of the total length; the fifth ray longest. Pectoral of blind side about  $\frac{3}{4}$  of the length of that of colored side, its rays once bifurcate, the first four excepted. Ventrals about half the length of the pectoral of the colored side; their posterior axil vertical with the anterior angle of the pectorals, and their four posterior rays bifurcate. Lateral line very gently curved above the pectoral, and contained 83 pores in specimens 10 inches long. Accessory lateral line variable in length, ending from the 30th to the 59th dorsal ray in different individuals, usually about equally developed on the blind side. Scales rather small, cycloid, subcircular; those of the anterior portion of the body not imbricated, but entirely surrounded by skin; those of the posterior part imbricated. Scales of the abdominal region smaller than those on the rest of the body; those upon the head narrow, much elongate, separate. Scales of the blind side similar in character to those on the colored side; those on the head like those on colored side of head. Snout, interocular space, and lower jaw scaleless. Dorsal and anal with three rows of small, narrow, elongate scales along each ray of their central portion, a few upon the blind side of those fins. Caudal covered with scales similar to those of the other vertical fins, but covering both rays and membrane on both sides of the body. Color of the eyed side dark olive-green, deepening almost to black on exposure to the air, and often blotched with whitish. Each of the body-scales tipped with black. Blind side opaque-white; a margin of yellow around the head from origin of dorsal to anus.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Total length, in inches.....	9 $\frac{5}{8}$	12 $\frac{1}{2}$	10 $\frac{1}{16}$	7 $\frac{7}{8}$	13 $\frac{1}{2}$	11 $\frac{7}{8}$	10
Total length without caudal.....	8 $\frac{1}{2}$						8 $\frac{1}{2}$
Greatest depth of body.....	4 $\frac{1}{16}$	5 $\frac{1}{16}$	5 $\frac{1}{16}$	3 $\frac{3}{4}$	6 $\frac{1}{2}$	5 $\frac{7}{8}$	4 $\frac{3}{8}$
Length of head.....	2 $\frac{1}{16}$	2 $\frac{3}{8}$	2 $\frac{1}{8}$	1 $\frac{7}{8}$	2 $\frac{1}{2}$	2 $\frac{5}{8}$	2 $\frac{3}{8}$
Longitudinal diameter of eye.....		$\frac{1}{16}$	$\frac{7}{16}$		$\frac{1}{2}$	$\frac{1}{2}$	$\frac{7}{16}$
Width of interocular space.....			$\frac{1}{8}$	$\frac{1}{16}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{3}{8}$
Length of snout.....		$\frac{5}{16}$	$\frac{9}{16}$	$\frac{1}{8}$	$\frac{3}{8}$		$\frac{1}{2}$
Length of pectoral, colored side.....	1 $\frac{3}{8}$	1 $\frac{3}{8}$	1 $\frac{1}{4}$	1 $\frac{5}{16}$	1 $\frac{1}{2}$	1 $\frac{3}{8}$	1 $\frac{3}{16}$
Length of pectoral, blind side.....	1	1 $\frac{1}{16}$	1 $\frac{1}{8}$		1 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{7}{8}$
Length of ventrals.....	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{5}{8}$				$\frac{9}{16}$
Distance of longest ray of dorsal.....	1 $\frac{1}{8}$	1 $\frac{7}{16}$				1 $\frac{3}{8}$	1
Distance in a straight line from tip of lower jaw to origin of anal.....	2 $\frac{7}{8}$		2 $\frac{7}{8}$	2 $\frac{1}{2}$			2 $\frac{7}{8}$
Distance from tip to tip of longest rays of dorsal and anal.....	6 $\frac{7}{8}$	8 $\frac{1}{16}$					
Length of lower jaw.....	$\frac{1}{16}$	$\frac{3}{8}$	$\frac{1}{16}$				$\frac{3}{16}$
Width of peduncle of tail, narrowest part.....	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{3}{16}$		1 $\frac{1}{2}$		1 $\frac{1}{2}$
Greatest distance from anal to straight part of lateral line.....		3 $\frac{1}{2}$				3 $\frac{1}{2}$	2 $\frac{7}{8}$

The interocular space in this species is narrow, perfectly smooth, and without ridge or concavity. No. 7 is an anomalous individual, colored similarly on both sides, except upon the cheeks and opercular apparatus of the blind side, which were yellow when fresh, but have faded to white in alcohol. In this fish, the upper eye is less lateral than usual, and, as if to give it more scope of upward vision, the dorsal outline and fin do not curve downwards to meet the curve of the snout, but end in a point about  $\frac{1}{4}$ " above the eye; the outline from the back of the eye to the point taking the form of a hollow or "scotia."

Girard first described this form in Proc. Ac. Nat. Sci. Phil. 1856, p. 137, and afterwards in the U. S. Pac. R. R. Rep. x, 152. His specimens came from Tomales Bay, an inland harbor similar to that of San Francisco, but smaller, and situated within the range of the fishing-vessels which supply the markets of San Francisco. Dr. Günther, writing in 1862, places *guttulatus* in the genus *Pleuronectes*, and quotes Girard's description, at the same time describing, under the name of *Parophrys ayresii*, a form that is evidently the one common in this market. In a note he states that "it appears to us specifically distinct from *P. canosa*," but makes no comparison between it and *P. guttulatus*.

A careful comparison of Girard's description of *guttulatus* with Günther's of *ayresii* reveals no differences except in the proportions, which are variable in most of our flat-fishes, and in the color, which is described by the latter as "uniform brownish lead-colored," by the former as "greyish or lead, sprinkled all over with black dots and whitish spots." In the only form which I have seen, the whitish spots are of frequent occurrence. The greatest discrepancy between the two descriptions is in the size of the eyes, which Girard states are "contained three times in the length of the side of the head," but which Günther gives as one-fifth of the length of the head. All the specimens I have seen agree in this respect, as also in other proportions, more closely with Günther's *ayresii*.

Gill (P. A. N. S. Phil. 1864, p. 196) queries the distinctness of *P. ayresii*, and his query tends to confirm the impression of the identity of the two species that I had formed before perusing his paper.

Most of the smaller specimens that I have examined have the number of rays of the dorsal and anal fins as given by Günther for *P. ayresii* (D. 66, A. 47), which differs from that given by Girard for *guttulatus* only in the absence of one dorsal ray; but larger examples have a much larger number of rays: No. 2 ( $12\frac{1}{4}$ " long) had 72 dorsal, 54 anal, and 13 pectoral rays; another specimen,  $12\frac{3}{4}$ " long, had D. 70, A. 48; and No. 5 had D. 71, A. 49. This species is very abundant, and is occasionally taken inside, but usually outside, the bay; it is called by the dealers "Turbot," and attains occasionally a length of 18", and a weight of about 5 pounds. It can be readily recognized by its broad form, convex caudal, the dark dull color of the eyed side, and the yellow margin round the head on the blind side. I am informed that the greater portion of the turbot brought here are taken in the vicinity of Tomales Bay.

## PLEURONICHTHYS CÆNOSUS Girard.

D. 72-76. A. 46-54. C. 3-14-3. P. 10-13. V. 6.

Body broad, comparatively thick; nape almost continuous with snout, and much less curved than the part of the dorsal outline immediately behind it. At the seventeenth dorsal ray the dorsal outline commences to rise rapidly, forming a bold and regular sweep from thence to the end of the dorsal. Abdominal outline nearly a straight line to the ventrals, thence curved like the dorsal. Greatest depth of body  $\frac{4}{9}$ , length of head about  $\frac{2}{3}$ , of the total length; longitudinal diameter of orbit nearly  $\frac{1}{3}$  of the length of the head; width from tip to tip of expanded dorsal and anal fins nearly  $\frac{2}{3}$  of the total length. Caudal peduncle usually about  $\frac{1}{3}$  as wide as the greatest depth of the body, widening considerably toward the caudal base. Snout extremely short and bluff, its length less than  $\frac{1}{4}$  of the diameter of the orbit, and its profile cut off from that of the nape by the projection of the upper orbital margin. Nostrils of right side in a depression on the horizon of the upper margin of the lower eye, those of the blind side on the dorsal ridge slightly behind the front margin of the orbit; both anterior nostrils with a flap; posterior patulous. Eyes elliptical, very large, even in front, the upper directed obliquely upwards, the upper bony ridge of its orbit raised above the dorsal ridge. Interocular space a very narrow bony ridge, its extremities raised into prominences, and scarcely  $\frac{1}{16}$ " wide in a specimen  $9\frac{1}{8}$ " long. This ridge continues forward round the anterior margin of the upper eye to its raised upper margin; on the posterior margin of the upper eye there are also two almost spinous prominences. Mouth small, extremely oblique, nearer vertical than horizontal; the end of the maxillary, in consequence of this obliquity, scarcely reaching the front margin of the orbit; mandible not projecting in the closed mouth. Lips thick, fleshy, and plicate. Teeth very small, acute, in a broad band in the mandible on the blind side and for about two-thirds of the length of the colored side. On the intermaxillaries a much narrower band on the blind side, scarcely reaching to the symphysis; none on the colored side of these bones. Teeth of the blind side of the mandible very slender, much recurved. Each upper pharyngeal with a row of about eight conical, sharp, recurved teeth; lower pharyngeals with a double row of very small teeth. All the teeth buried deeply in the gum, only their points visible. The lower pharyngeal bones are very small and slender. A prominent short ridge between the origin of the lateral line and the tubercles of the hinder margin of the upper eye; from the anterior end of this a long low prominence runs downwards across the opercular bones, slightly inclining forwards, and ending level with the row of pores under the eye. Margin of the preoperculum united by the skin to the other opercular bones. Gill-rakers very short, flexible, wide apart. Dorsal fin twisted over to the left side at a point over the centre of the eye (about ten rays from its origin) and continued downwards in a curved line to a little below the posterior extremity of the maxillary on that side, the first rays

higher than those immediately following. The rays again increase to about the forty-fifth, where the fin forms almost an angle, the rays rapidly diminishing to its termination opposite that of the anal, at about half the depth of the peduncle from the caudal. Anal commencing a little behind the base of the pectoral, similar to the dorsal, its longest rays about the 23d-25th, where the fin forms a rounded angle similar to that of the dorsal, the rays diminishing thence regularly and rapidly. Longest rays of dorsal and anal about  $\frac{2}{3}$  of the length of the head. Anal usually with a small spine; all the rays of dorsal and anal simple; those behind the longest rays inclined forwards. Caudal rather broad, its rays twice bifurcate; the first bifurcation at about the middle, the second at three-fourths of their length from the base; posterior margin regularly convex. Pectoral rather short; that of colored side contained  $7\frac{1}{2}$ - $8\frac{1}{2}$  times in the total length, about  $1\frac{2}{3}$  times in that of head; that of blind side much shorter, about  $\frac{9}{22}$  of the length of the head. Rays of pectoral of colored side once bifurcate, the two uppermost excepted; those of the blind side undivided. Ventrals  $\frac{4}{5}$  of the length of the head, their rays undivided, and the tips of the fins extending beyond the origin of the anal; their base very broad, its posterior portion below the anterior portion of the pectoral base. Lateral line median on the caudal peduncle, and thence forwards to nearly the tip of the pectorals, where it commences to rise slightly, with very small curvature, to its origin. Accessory lateral line ending below the 45th-53d ray of the dorsal; that of the blind side rather shorter. A line of pores commences at the tubercles on the posterior margin of the upper eye, is continued behind the lower eye at some distance from it, and thence along the suborbitals to a line with the front of the pupil—about sixteen tubular pores. Scales rather small, smooth, not imbricated, except on the caudal peduncle, but imbedded in the skin; those on cheeks and opercles smaller, and those of the left side considerably smaller than those of the right. Snout, interocular space, and lower jaw scaleless. Several rows of extremely small scales on dorsal and anal rays; caudal rays with very small scales on both sides. Color of a fresh individual dark chocolate-brown, becoming reddish on the lower part of the head; after exposure to alcohol the color becomes duller, and the scales show distinctly lighter than the surrounding skin. Others are olivaceous. All are much lighter when covered with mucus. Blind side creamy white, in some spotless, in others with three or four large, and several smaller, dark-brown blotches on the anterior portion of the body. Dorsal and anal fins clouded with dark and light olivaceous; pectoral of colored side dark.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Total length, in inches .....	12 $\frac{3}{8}$	11 $\frac{5}{16}$	10 $\frac{7}{8}$	9 $\frac{1}{8}$	6 $\frac{1}{8}$
Length without caudal .....	10 $\frac{1}{4}$	9 $\frac{3}{16}$	.....	.....	4 $\frac{13}{16}$
Length of head .....	2 $\frac{3}{4}$	2 $\frac{1}{2}$	2 $\frac{3}{8}$	1 $\frac{11}{16}$	1 $\frac{1}{4}$
Greatest depth of body .....	5 $\frac{3}{8}$	5 $\frac{1}{8}$	4 $\frac{3}{8}$	4 $\frac{1}{8}$	2 $\frac{11}{16}$
Depth from tip of dorsal to that of anal .....	8 $\frac{1}{8}$	.....	.....	.....	.....
Length of lower jaw .....	.....	3 $\frac{1}{8}$	.....	.....	7 $\frac{1}{8}$
Distance from tip of lower jaw to origin of anal .....	.....	2 $\frac{3}{8}$	.....	.....	1 $\frac{11}{16}$
Width of caudal peduncle .....	1 $\frac{1}{8}$	1 $\frac{1}{32}$	.....	3 $\frac{9}{16}$	$\frac{1}{2}$
Longitudinal diameter of lower eye-ball .....	1 $\frac{3}{8}$	1 $\frac{3}{8}$	3 $\frac{5}{8}$	$\frac{1}{2}$	1 $\frac{3}{8}$
Length of pectoral, colored side .....	1 $\frac{5}{8}$	.....	1 $\frac{1}{4}$	1 $\frac{1}{16}$	3 $\frac{1}{2}$
Length of pectoral, blind side .....	1 $\frac{1}{8}$	.....	1	1 $\frac{5}{8}$	7 $\frac{1}{8}$
Length of ventrals .....	.....	1 $\frac{3}{8}$	.....	3	.....
Length of snout, from a line joining the orbits .....	7 $\frac{1}{8}$	.....	$\frac{1}{8}$	5 $\frac{1}{2}$	$\frac{1}{2}$
Distance from origin of anal to lateral line .....	.....	2 $\frac{3}{8}$	2 $\frac{1}{16}$	2 $\frac{1}{16}$	1 $\frac{3}{8}$
Number of dorsal rays .....	76	72	72	72	76
Number of anal rays .....	52	50	49	51	46

Another specimen had 73 dorsal and 53 anal rays. In consequence of the height and size of the prominences round the upper eye, the upper orbit is larger than the lower. The species appears to be rare; Girard saw only one specimen, and as yet I have only seen about twelve. It is taken outside the bay in deep water, probably near the Farallone Islands. The large eyeballs, protruding through the diminution of the pressure consequent on the removal of the fish to the surface, and overhanging, as it were, the short, snub snout, together with the bright brown tint, give this fish an unmistakable physiognomy even when viewed from above; and the curious prolongation of the dorsal on the left side, together with the brown markings, render it still more easy to identify when the blind side is exposed to view.

Is *Pleuronectes quadrituberculatus* Pall. (Zoog. Ross.-As. iii, p. 423, teste Günther) identical with the foregoing? The two "approximate, anteriorly situated" tubercles may very well be the prominent extremities of the interocular ridge; there is another "at the hinder margin of the upper orbit" (with, however, a second above it), and that above the opercle is large and prominent. The fin-rays, lateral line, and scales agree perfectly well with this species; but the proportion of depth to length is smaller, and "anal spine hidden" does not apply to the specimens of *carnosus* brought to this market. Yet the proportion of the body is within the range of variation of some of our other flat-fishes, and the anal spine is not prominent. It is also a suspicious circumstance that no one has ever identified Pallas's species.

If my surmise should prove correct, *carnosus* must of course sink into a synonym, and the name of the species will be *Pleuronichthys quadrituberculatus*.

In No. 4, the dorsal fin was not continued downwards nearly so far as in the others, agreeing thus more closely with Girard's description; the first ray was about level with the top of the upper lip, and only four



rays arose upon the blind side. In the same individual, no anal spine was discoverable outside of the skin; and the rays of the pectoral on the blind side were only ten, and on the colored side twelve.

In No. 5, no scales were discoverable on the vertical fins. One individual examined had three tubercles in a vertical line along the posterior margin of the upper eye.

### PAROPHRYS Girard.

Eyes and color on the right side. Form elongate-rhombic; anterior part of head narrow; snout conic. Eyes contiguous, nearly even, the upper looking obliquely upwards. Nostrils on horizon of superior margin of each orbit, anterior subtubular, posterior with anterior flap. Mouth unequal, little oblique; maxillary bones of colored side extending little beyond anterior margin of orbit, much shorter than that of blind side. Lips rather thin and simple. Teeth most developed on the blind side, in a single series, contiguous. An accessory lateral line. Lateral line with a very slight arch, almost straight, but somewhat raised in front. Scales cycloid, those on the cheeks similar. A recumbent spine before the anal. Caudal almost straight on posterior margin. Branchiostegals seven. Lower pharyngeals with a double row of teeth.

### PAROPHRYS VETULUS Girard.

*Parophrys hubbardi* Gill.

*Pleuronectes digrammus* Günther.

*Parophrys vetulus* Gill.

*Parophrys vetulus* Günther.

D. 74-86. A. 54-68. C. 3-6-1-5-3=18. P. 1-11. V. 6.

Body elongated, tapering posteriorly, less so anteriorly; the greatest width about a third of the total length; head one-fourth of the same, or rather less. Peduncle of tail rather slender, rather more than one-fifth of the greatest width. Outlines of posterior portion of body only very slightly curved; snout about  $\frac{2}{3}$  of length of eye, narrow, its convexity meeting that of the anterior part of the dorsal outline above the centre of the pupil of the upper eye. Eyes from rather less to rather more than  $\frac{1}{4}$  of the length of the head, elliptical, the lower in advance of the upper by a distance equal to about  $\frac{2}{3}$  of the depth of the pupil; upper eye almost on a plane with the dorsal outline. Interocular space narrow, ridge-like, elevated, the ridge continued backwards and obliquely upwards round the posterior border of the upper eye, and then to the lateral line above the opercle. A short raised ridge along the anterior margin of the lower orbit. Nostrils of both sides in a slight depression; anterior of right side tubular, that of left side with a posterior linguiform flap. Mouth small, its cleft much longer on the blind side than on the colored; maxillary of the colored side scarcely passing the front margin of the orbit; mandible projecting in the closed mouth, its tip



level with the upper margin of the lower eye. Both intermaxillaries and mandibles are distorted, their symphyses bent round toward the colored side. Teeth small, short, broad, nearly equal, closely set, forming a nearly continuous cutting edge on the blind side in both jaws; about 40 teeth in the intermaxillary and 45 in the mandible on the blind side, and 2-3 on the colored side of each jaw, in a specimen  $12\frac{3}{4}$ " long. Pharyngeal teeth blunt, broad, similar to those of jaws; each upper pharyngeal bone with about 12 teeth; each lower pharyngeal bone with a double row of teeth. Lower pharyngeals stout, separate. Gill-rakers of first arch rather slender, about one-fourth as long as the eye, the others decreasing regularly to the fourth arch, on which they are almost tubercular. Dorsal commencing over the centre of the pupil of the upper eye, considerably behind the posterior nostril of blind side; the number of rays very variable, the longest (39th-40th about) more than  $\frac{1}{4}$  of the length of the head. Anal with a horizontal spine, its first ray arising at a vertical about the width of the pectoral base behind the posterior pectoral axil; the number of rays very variable; the longest (C. 18-20) opposite to those of the dorsal. Dorsal and anal coterminous at a distance from the caudal exceeding the depth of the caudal peduncle. Caudal truncated posteriorly, the outermost principal rays only very slightly longer than the central ones when closed, so that the fin when opened is slightly convex, the rays once bifurcate only. Pectoral of colored side usually about  $\frac{1}{3}$  of the total length; the rays mostly once bifurcate, the two first excepted. Pectoral of blind side usually considerably shorter than that of the colored side; rays bifurcate, except the first three. Ventrals inserted with their posterior axil nearly in a line with the anterior axil of the base of the pectorals, their posterior extremity extending about to the anal spine; the posterior four rays bifurcate once or twice. Scales very small, smooth, extending over the head to the nostrils and over the base of the caudal, but not on the dorsal or anal. Snout and lower jaw scaleless. Scales of blind side similar. Each scale is sub-elliptical, longer than deep. Lateral line raised anteriorly, and with a very slight arch over the pectoral, thence straight to the end of the caudal; about 103-108 scales (in specimens  $11\frac{1}{2}$ - $13\frac{3}{8}$  long) from base of caudal to head. Accessory lateral line ending at from the 26th to the 28th ray of the dorsal; an accessory line on the blind side also of about the same length. Color of body uniform reddish brown, sometimes spotted darker when fresh, especially in small specimens. Left side uniform whitish. Smaller specimens lighter in tint than larger.

Dimensions of several specimens.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Total length, to tip of caudal, in inches .....	8 $\frac{5}{16}$	9 $\frac{5}{16}$	10 $\frac{1}{2}$	11 $\frac{1}{2}$	12 $\frac{3}{4}$	13 $\frac{3}{8}$	14 $\frac{5}{8}$
Greatest width of body .....	2 $\frac{1}{16}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{16}$	4 $\frac{1}{4}$	4 $\frac{1}{2}$	.....
Length of head .....	1 $\frac{1}{16}$	2 $\frac{1}{16}$	2 $\frac{1}{16}$	2 $\frac{1}{16}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$
Distance from tip of lower jaw to anal, in a straight line .....	2 $\frac{5}{8}$	2 $\frac{7}{8}$	.....	3 $\frac{1}{8}$	4 $\frac{1}{16}$	4 $\frac{5}{8}$	.....
Length of pectoral, colored side .....	1 $\frac{1}{16}$	1 $\frac{1}{8}$	.....	1 $\frac{7}{16}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
Length of pectoral, blind side .....	$\frac{1}{16}$	$\frac{3}{4}$	.....	$\frac{7}{8}$	1 $\frac{3}{16}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$
Length of ventrals .....	$\frac{9}{16}$	$\frac{5}{8}$	.....	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	1
Length of orbit .....	$\frac{1}{2}$	1 $\frac{1}{16}$	.....	1 $\frac{1}{16}$	3 $\frac{1}{2}$	$\frac{3}{4}$	2 $\frac{7}{8}$
Approximate width of interocular space .....	3 $\frac{3}{8}$	1 $\frac{1}{8}$	.....	5 $\frac{1}{2}$	5 $\frac{1}{2}$	8	5 $\frac{1}{2}$
Width of peduncle of tail .....	.....	.....	.....	.....	.....	1 $\frac{1}{8}$	1 $\frac{1}{8}$
Length of lower jaw .....	.....	.....	.....	.....	.....	1 $\frac{1}{8}$	.....
Length of snout .....	1 $\frac{1}{2}$	2	.....	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	.....
Origin of anal to lateral line .....	.....	.....	.....	.....	.....	.....	3
Number of rays in dorsal .....	78	81	79	81	85	86	80
Number of rays in anal .....	60	61	60	68	65	68	61

In other specimens, the formulæ of these fins were as follows: D. 77, A. 60; D. 74, A. 57; D. 75; A. c. 54. Thus the number of rays in the dorsal and anal fins is very variable, and is usually largest in the largest individuals, but not invariably so; the head also becomes slightly longer in proportion to the body as the size increases; and the largest specimens are the most slender. After close examination of several individuals, and comparison of many fresh specimens as they lay upon the stalls, exposed for sale, I have been forced to the conclusion that there is only one species of *Parophrys*, and that the *P. hubbardi* of Gill and the *P. digrammus* of Günther must sink to the rank of synonyms. *Parophrys retulus* is of common occurrence in the markets, where it is present daily in greater or less abundance. Large specimens are equal in length to those of *Psettichthys melanostictus*. This species can be readily recognized by its narrow form, combined with the straight tapering lines of the posterior portion of the body, by the narrow anterior portion of the head, and by the smooth scales.

#### LEPIDOPSETTA Gill.

Form oval; eyes and color on the right side. Mouth small, the narrow maxillary reaching but little behind the anterior margin of the orbit of the lower eye; teeth in a single row, straight, forming a blunt continuous edge, most developed on the blind side. Anterior nostril of colored side tubular; that of blind side with a linguiform flap. Branchiostegals seven. Dorsal not extending in advance of the orbit; anal with a spine. Scales rough, usually ctenoid, sometimes sub-spinosely tuberculate on the cheeks. Lateral line arched anteriorly; an accessory dorsal branch.

## LEPIDOPSETTA BILINEATA (Ayres) Gill.

*Platessa bilineata* Ayres.

D. 71-84. A. 55-63. C. 3-12-3. P. 11. V. 6. L. lat. 82-86.

Form oval; dorsal profile regularly curved from the front margin of the upper eye to the caudal peduncle. Abdominal outline also a regular curve from the lower jaw, but less arched than the dorsal. Curve of snout uniting with that of nape over the anterior margin of the upper eye, forming a concavity. Height of body about  $\frac{2}{3}$ ; length of head rather more than  $\frac{1}{4}$  of the total length; greatest distance from anal to straight part of lateral line nearly equal to the length of the head. Snout projecting slightly, and considerably shorter than the eye. Eyes rather large, elliptical, their longitudinal diameter about  $\frac{2}{3}$  of the length of the head, nearly even in front; the upper eye looking obliquely upwards. Interorbital space a very narrow, elevated, bony ridge, dividing anteriorly, and forming a raised ridge round the anterior margin of each eye. Nostrils of colored side in a depression about equidistant from the front margins of the two orbits; anterior tubular; posterior patulous; anterior nostril of blind side with a posterior tongue-like flap. Mouth very oblique; tip of mandible level with the upper margin of the lower eye, projecting when the mouth is closed, with a prominent symphysial knob. Length of mandible contained about  $2\frac{2}{3}$  times in that of head. Maxillary reaching but little behind the anterior margin of the orbit of the lower eye, and about  $\frac{1}{3}$  of its transverse diameter below its lower margin. A single, rather irregular, tolerably closely set row of strong, blunt, conical teeth in each jaw, shorter and less developed on the colored side than on the blind. Teeth of intermaxillary not reaching above half-way along that bone on the colored side; those of mandible extending along  $\frac{2}{3}$  of the exposed portion of that bone on the same side. About 34 teeth in the intermaxillaries, and about 32 in the mandible. Inferior pharyngeal teeth like those of jaws, but stouter, in a double row on each pharyngeal bone, the outer row rather the smaller; about 12 teeth in the inner row; superior similar, in a single row of about 7 on each pharyngeal bone. Inferior pharyngeal bones entirely separate, stout, broadest in the centre of their length, where the rows of teeth are farthest apart. Dorsal commencing immediately behind the anterior margin of the orbit; its first ray twisted toward the left, increasing regularly to about the 38th-40th rays, which are about  $\frac{1}{5}$  of the length of the head, thence diminishing regularly to its termination opposite to that of the anal and distant from the caudal about half the width of its peduncle. Anal with a spine, its origin a little behind the base of the pectoral, its longest rays opposite to and equal in length to those of the dorsal; behind the longest rays the depth of the fin diminishes regularly. Narrowest part of caudal peduncle rather more than  $\frac{1}{5}$  of the greatest depth, thence widening to the caudal without the intervention of a straight portion. Principal rays of caudal once bifurcate; its posterior margin slightly

convex. Pectorals pointed; that of colored side with 11-12 rays, the longest about  $\frac{5}{11}$  of the length of the head; all the rays, except the first two, once bifurcate. Pectoral of blind side with 10-11 rays, the longest about  $\frac{2}{3}$  as long as those of the colored side; the three or four lowest rays once bifurcate. Ventrals more than half their length in advance of the pectorals (reckoning from the front margins of both fins), contained about  $3\frac{1}{4}$  times in the length of the head; the three posterior rays bifurcate. Gill-rakers short, very flexible, few, and widely separated. Scales of the anterior part of the body separate and almost circular, but towards the central portion they slightly overlap, and on the posterior portion are strongly imbricated. By far the larger portion of the scales on the anterior portion of the body and along the dorsal and abdominal regions, almost all those on the sub- and inter-opercula, a large proportion of those on operculum, and some of those on the suborbital region smooth, subcircular. On the central portion of the length, especially near the lateral line, scales with two or three spinules appear, and these become more numerous and more decidedly ctenoid farther backwards, extending quite across the body on its posterior third. Scales of cheeks not imbricated, similar in shape to those of body; the posterior portion of their surface covered with numerous spinules (number variable) directed upwards. Near the interorbital space these spinules cover the greater portion of each scale. These spinulose scales extend upwards level with the upper margin of the upper eye; and there are numerous scales of a similar character on the operculum, and sometimes a few upon the sub- and inter-opercula. A few isolated scales below the pectoral resemble those on the cheeks. Each of the scales on the cheeks with a distinct pit, producing a punctate appearance. In some specimens spinulose scales are scattered over the anterior parts. Scales of blind side smooth; preoperculum scaleless. Accessory lateral line of variable length, connected with the main lateral line by a branch and sometimes with a short separate row of pores above; accessory lateral line of blind side shorter. Lateral line with a bold curve, six scales high (in an oblique row) above pectoral, anteriorly decurrent to nearly its former direction. A row of pores round the lower eye. Rays of the caudal covered with scales on both blind and colored sides. A row of scales along the greater portion of the length of the central rays of the dorsal on the colored side and on a portion of the anal, but no scales upon the anterior or posterior rays of either fin on that side, nor on either dorsal or anal on the blind side. The scales of the body are largest on the posterior portion and on the caudal peduncle, where they are elongated, and measure about  $\frac{5}{32}$  in length. Color light grayish, yellowish, or reddish brown, with irregularly placed blotches of whitish on the body; often with five large light blotches along the dorsal and five along the abdominal margin. Blind side white. Dorsal fin sometimes with blotches on colored side.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Total length, in inches.....	13 $\frac{3}{16}$	14 $\frac{1}{2}$	14 $\frac{5}{8}$	13 $\frac{1}{16}$	14 $\frac{1}{16}$
Greatest depth of body.....	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{3}{8}$	5 $\frac{5}{8}$	5 $\frac{1}{4}$
Length of head.....	3 $\frac{7}{16}$	3 $\frac{1}{2}$	3 $\frac{5}{8}$	3 $\frac{3}{8}$	3 $\frac{3}{8}$
Length of snout, from a line joining the front margins of the orbits.....	$\frac{9}{16}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$
Longitudinal diameter of lower orbit.....	$\frac{1}{16}$		$\frac{1}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
Interocular width.....	$\frac{1}{16}$	$\frac{1}{16}$		$\frac{3}{32}$	$\frac{3}{32}$
Length of mandible.....			1 $\frac{3}{8}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$
Length of pectoral, colored side.....	1 $\frac{3}{16}$	1 $\frac{3}{4}$	1 $\frac{1}{4}$	1 $\frac{9}{16}$	1 $\frac{3}{2}$
Length of pectoral, blind side.....	1 $\frac{1}{8}$	1 $\frac{1}{4}$	1 $\frac{1}{16}$	1	1
Length of ventrals.....	1 $\frac{1}{16}$	1 $\frac{1}{8}$	1 $\frac{1}{4}$	1 $\frac{1}{32}$	1 $\frac{1}{16}$
Tip of snout to origin of anal.....	4 $\frac{3}{8}$	4 $\frac{7}{8}$	5	4 $\frac{1}{2}$	4 $\frac{5}{16}$
Length of longest rays of dorsal.....	1 $\frac{1}{4}$	1 $\frac{1}{16}$	1 $\frac{1}{16}$	1 $\frac{1}{16}$	1 $\frac{1}{16}$
Width of caudal peduncle.....	1 $\frac{1}{8}$	1 $\frac{1}{16}$	1 $\frac{1}{8}$	1 $\frac{1}{4}$	1 $\frac{1}{8}$
Greatest distance from anal to straight part of lateral line.....			3 $\frac{3}{8}$	3 $\frac{1}{4}$	3

The accessory lateral line varies considerably. In No. 1, it can be traced to below the fortieth dorsal ray; the portion anterior to the branch connecting it with the main lateral line runs obliquely upwards to immediately below the sixth dorsal ray; and there is a short line of about eleven pores above the principal accessory lateral line, commencing at the tenth dorsal ray and continuing to the fifteenth. In No. 2, there is no second accessory row of pores, and the accessory lateral line terminates between the fifteenth and sixteenth dorsal rays. Anteriorly this line divides and again unites, surrounding a small space, and then again divides into two branches, the lower of which receives the connecting branch from the main lateral line. In No. 3, the accessory lateral line ends just behind the sixteenth dorsal ray, and has two branches inclined upward, the anterior surrounding a space. On the blind side of No. 4, I could only find ten pectoral rays. On the blind side of Nos. 4 and 5, the accessory lateral line, which ends under the 14th dorsal ray, curves boldly downwards and then backwards to meet the main lateral line, and sends a short branch obliquely forwards. On the colored side the arrangement is similar in No. 5; but in No. 4 a space is surrounded by the pores at the junction of the dorsal accessory with the branch leading to the lateral line.

This large mottled "Sole" (as it is called) is taken outside of the bay, usually, if I am rightly informed, in the vicinity of the Farallones, and is rather rare. Those brought in are usually of tolerably large size, the specimens measured being of about average dimensions. It is reputed of delicate flavor. It may be readily recognized by its light yellow tint, with white markings, its regularly oval form, and its extremely narrow interocular space.

The formulæ of the dorsal and anal in the individuals measured were as follows: No. 1, D. 78, A. 57; No. 2, D. 76, A. 61; No. 3, D. 71, A. 55; No. 4, D. 76, A. 61; No. 5, D. 84, A. 63.

In No. 4, the last two or three rays of the dorsal and anal were once bifurcate; and in both No. 4 and No. 5, those rays of the dorsal and anal

which inclined forwards (about 25 in No. 4 and about 30 in No. 5) were without scales. In Nos. 4-5, the length of the arch of the lateral line was two inches, its rise half an inch, and the number of pores between caudal and head 82 and 86 respectively.

LEPIDOPSETTA UMBROSA (Grd.) Gill.

*Platichthys umbrosus* Girard.

D. 85-90. A. 66-68. C. 3-12-3. P. 11-12. V. 6. L. lat. 82-86.

Body ellipsoid, regularly and about equally curved on dorsal and abdominal profiles; snout strongly curved, its curve meeting that of the dorsal outline at a considerable angle opposite the front margin of the upper orbit; lower margin of head and that of mandible almost in the same line. Greatest depth of body contained  $2\frac{4}{5}$ - $2\frac{2}{3}$  times, that of head  $4\frac{1}{5}$ - $4\frac{3}{4}$ , in the total length; eye about 6 times, snout (measured from a line joining the anterior margins of the orbits) about  $5\frac{1}{2}$  times, in the length of the head; caudal peduncle  $4\frac{1}{2}$  times in the greatest depth of the body. Nostrils of colored side in a horizontal line with the centre of the interocular space, anterior tubular, posterior patulous; anterior nostril of blind side with a posterior linguiform flap. Eyes small, lateral, even in front, the upper anterior part of the orbit of the upper eye nearly reaching the dorsal outline at the point of its junction with the snout. Interocular space equal in width to about  $\frac{1}{3}$  the longitudinal diameter of the eye; the surface flat, not elevated, without ridges or tubercles. Mouth small, its cleft oblique; lower jaw projecting in the closed mouth, and level with the upper margin of the lower eye; maxillary ending about half-way between the front margin of the orbit and that of the pupil. Teeth in a single row on both sides of both jaws; about 14 on the colored and 23 on the blind side of the mandible, and 20 on the colored and 23 on the blind side of the intermaxillaries in a specimen a little over 9" long. Teeth conical, rather short and stout; the largest in front of both jaws, the smallest on the colored side of the intermaxillary. Upper pharyngeal teeth in a single row of 6-8 teeth similar to those in jaws; lower pharyngeals separate, each with a double row of similar teeth. Gill-rakers short, flexible; branchiostegals seven. Dorsal commencing above anterior margin of eye; the first ray slightly turned to the left at its origin; the longest rays (about the 38th-48th) about equal in length to the pectoral of the right side, thence decreasing regularly to its termination, opposite to that of anal, at a distance from the caudal equal to about half the depth of the peduncle. Anal with a more or less conspicuous spine, very slowly increasing in height to the 30th-33th rays, which are equal in length and opposite to the longest dorsal rays. By far the larger portion of the rays of the dorsal and anal are directed backwards. Origin of anal considerably behind the pectoral base. Greatest depth between anal and straight portion of lateral line somewhat less than the length of the head. Caudal peduncle slightly wedge-shaped; caudal convex posteriorly, the central rays considerably longest; outer ray about  $\frac{1}{3}$ , second ray about  $\frac{2}{3}$ , the length



of the third ray on each side; rays usually only once bifurcate. Ventrals small; their posterior axil about half the width of the pectoral base in advance of the anterior axil of that fin, their tips extending beyond the anus; four lower rays bifurcate. Pectoral of colored side lanceolate, about half the length of the head; third ray longest, second slightly shorter; all the rays but the three uppermost once bifurcate. Pectoral of blind side shorter, the central rays longest; most of the rays once bifurcate. Scales of body and cheeks etenoid, the spines well developed, those on the cheeks similar; no stellate or rugose scales on any part. Small etenoid scales on interorbital area; snout and lower jaw scaleless. A row of etenoid scales along each ray of dorsal and anal fins on the colored side, except upon a few of the anterior rays and those posterior ones which incline forwards. The scales extend to the tips of the rays. Similar scales upon the colored side of the caudal for the greater portion of the length, and some on the outside of the pectoral. Scales of blind side smooth; preopercular bone scaleless; the other opercular bones partially so. A row of smooth scales along the front edge of each ray of the central portion of dorsal and anal on the blind side, not extending above  $\frac{1}{3}$  of the length. Lateral line with about 82-86 scales; a more or less conspicuous arch above the pectoral, in most cases rising about two scales high. Accessory lateral line ending below the 23d-27th dorsal ray on the colored side, and below the 16th-24th ray on the blind side. A branch from the main lateral line joins the accessory line a little posterior to its origin, the accessory line forming an obtuse angle, or sometimes branching, at the junction. Color nearly uniform grayish brown on the colored side; blind side white. Each scale of colored side with a dark band behind the spines, then a light area. Fins on colored side nearly the same color as the body.

Dimensions.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Total length, in inches .....	9 $\frac{9}{16}$	10 $\frac{1}{4}$	9 $\frac{5}{16}$	9 $\frac{5}{16}$	8 $\frac{7}{16}$
Length without caudal .....	9 $\frac{7}{8}$	9	7 $\frac{11}{16}$	7 $\frac{11}{16}$	7
Greatest depth of body .....	3 $\frac{1}{2}$	4 $\frac{1}{8}$	3 $\frac{5}{16}$	3 $\frac{1}{2}$	3
Greatest distance between anal and straight portion of lateral line .....	1 $\frac{11}{16}$		2 $\frac{1}{16}$	2 $\frac{1}{16}$	1 $\frac{11}{16}$
Tip of lower jaw to origin of anal .....	2 $\frac{1}{4}$	3 $\frac{1}{8}$	2 $\frac{1}{16}$	2 $\frac{1}{4}$	2 $\frac{1}{8}$
Length of head .....	2	2 $\frac{5}{16}$	2	2 $\frac{1}{8}$	1 $\frac{17}{16}$
Length of snout, from upper eye .....	$\frac{11}{16}$	$\frac{3}{2}$			$\frac{1}{2}$
Longitudinal diameter of eye .....	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{5}{16}$
Width of interocular space .....			$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
Length of lower jaw .....			$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{8}$
Length of pectoral, colored side .....	1	1 $\frac{1}{16}$	$\frac{3}{16}$	1 $\frac{3}{16}$	1
Length of pectoral, blind side .....	$\frac{3}{4}$	1 $\frac{1}{16}$	$\frac{1}{16}$	$\frac{3}{4}$	1 $\frac{1}{16}$
Length of ventrals .....			$\frac{1}{2}$	$\frac{9}{16}$	$\frac{1}{2}$
Width of caudal peduncle .....	3 $\frac{1}{2}$	7	3 $\frac{1}{2}$	4	3 $\frac{1}{2}$
Length of longest dorsal rays .....			3 $\frac{1}{2}$	1 $\frac{1}{16}$	
Length of longest anal rays .....			3 $\frac{1}{2}$	1 $\frac{1}{16}$	
Number of dorsal rays .....	88	85	90	90	85
Number of anal rays .....	68	66	68	67	66
Lateral line .....		ca. 86	ca. 84	ca. 82	

This species is not brought to market in large numbers, and is sold under the name of "Sole." Those I have seen on the stalls average about the same size as those of which the measurements are given. In No. 5, the lateral line is almost straight. It is easily distinguished by its highly ctenoid scales of uniform character, its small eyes, and dull gray color.

It is evident from the dimensions of the various species given in the preceding pages, that the number of dorsal and anal fin-rays and the proportional width of the interocular space are subject to great variation in all the species. I am inclined to believe that, as a rule, the interocular space increases in proportional width with the age of the fish, since, although two fishes of the same size may differ in this respect, or the smaller of two not greatly differing in size may have the wider interorbital area, yet very large specimens invariably have this space relatively wider than very small ones. The number of pectoral rays is also inconstant.

I much regret that, as I have only seen one specimen of the *Hippoglossus* of this coast, I am at present unable to settle the question of its identity with the European species; but I expect to be able to do this before many months have passed.

In conclusion, I have to thank Mr. W. G. W. Harford, the Director of the Museum of the California Academy of Sciences, for his courtesy and his assistance in many ways.

MAY 14, 1879.

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**A PRELIMINARY CATALOGUE OF THE FISHES OF THE ST. JOHN'S RIVER AND THE EAST COAST OF FLORIDA, WITH DESCRIPTIONS OF A NEW GENUS AND THREE NEW SPECIES.**

**By G. BROWN GOODE.**

In the following list are enumerated the species of fishes known, or supposed to occur, in the waters of East Florida. Those which have not been observed by the writer, or by other recent explorers, are marked by asterisks. The occurrence of all these species is almost absolutely certain, for, with one or two exceptions, they have been taken on the Atlantic coast north of Florida, and to the south and west in the Gulf of Mexico or the Antilles. Any information regarding the occurrence of these or other species in East Florida is solicited.

In a more extended paper, now almost ready for the press, the habits, geographical distribution, and economical history of these species will be discussed. Of the 223 species here catalogued, 33 only have been taken north of Cape Cod.

SMITHSONIAN INSTITUTION, May 23, 1879.